Points to be put on chart

1. Put every thing on chart that you would report to head nurse
2 Nourishmen - meals - amt eaten
3 Fluids taken, + void
4 Enema + results + flatus
5 Treatment
6 Vomitus - amt - characters
7 amt of Sleep
8 change in condition
9 chill - time - duration
10 T. by rectum during + ½ hr after chill
11 Any mental symtoms
12 any thing that sounds like depression from a pt. report to sup. & chart
13 In case of accident
14 delerium
15 sudden death
} a nurse should be prepared to give an accurate + full report to the entire satisfaction of those to whom she is responsible
16 see every patient in your care every ½ hour.

graphic chart kept forever
Bed side notes " 2 yrs.

TEXT-BOOK OF
THE PRINCIPLES AND PRACTICE
OF NURSING

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TEXT-BOOK OF THE PRINCIPLES AND PRACTICE OF NURSING

BY

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PREFACE TO SECOND EDITION

The author's chief aim in the revision of this book is to continue its essential usefulness as a textbook in Schools of Nursing, and in the various fields of nursing in the home or community, where the first edition has had such a gratifying reception. In this effort five educational principles have been chiefly in mind:

First, to emphasize and to keep before the minds of students the three important and fundamental aspects and functions of nursing, common to all its various fields of activity. These are, (1) the maintenance of health and health teaching, (2) the prevention of disease, and (3) the cure of disease. The nature and demands of hospital experience necessarily stress the last function and are in danger of obscuring the preceding essential aspects unless especially emphasized both in theory and practice. Both the need and the opportunities for such teaching, however, are increasing with the changing and broadening conception of the function of the hospital in the community health program, and with the growing recognition and appreciation of the fact that the nurse must be prepared, not only to meet the needs of the hospital, but to function in this broader field in which she, as a teacher and health worker, is acknowledged to be the most important factor.

Second, to emphasize and keep before students the fact that the nursing profession has its own ideals and standards, its own body of knowledge, its own skills, its own special function and contribution, as distinct from medicine, in the maintenance of health, and the prevention and cure of disease. This distinct contribution of nursing, although it applies the principles and methods of psychology, hygiene and the biological, social, and physical sciences, all too frequently fails to receive due recognition, partly because too often nursing is carried out merely in accordance with certain rules which apply to all alike. This does not make for real professional service. For instance, a bath will be given, when convenient, because it is the *rule* to give two baths weekly; whereas the bath should really be given at a certain time, because of a certain condition, and because it is the best means of relieving annoying symptoms, or inducing sleep, or of cleansing and refreshing, or of obtaining some other definite, desired end. Compare this with medical practice or with any other professional service.

Third, to emphasize underlying principles and to focus attention on the *patient,* on the *condition to be treated,* and on the *end to be achieved,* and to show the procedure in its true relationship and perspective as a *means to an end,* varying with the condition, the situation and the end desired, so that each act thus involves an *understanding of the condition,* a *choice or comprehension of ends,* the *selection of the best means,* and *skill* in applying it.

Fourth, to help the students in the difficult problem of orientating or adjusting, and of building up proper associations, by presenting the contents from the psychological viewpoint in accordance with the laws of learning. The needs of both teacher and student, and the actual setting where nursing is taught, have been kept constantly in mind. The general plan of the text, stated by many to have been of great help to both teachers and students, has therefore been retained. Changes have been made in the hope that they will be of further help. Some have been made to avoid repetition and to give a unified presentation.

In *using the text,* however, it should be remembered that the principles governing the organization of material in a textbook, where unity and economy of space are essential, will not always permit conformity with the principles governing the selection of material, and the organization, sequence and presentation of lessons in teaching. The following factors of great importance in teaching and learning are not uniform and therefore require constant care in further selection and adaptation: (1) The *setting* varies not only in different hospitals, but in the same hospitals at different periods. Thus the lessons will vary with the *felt need* and in accordance with the *basic principle of correlation* of different subjects and of theory and practice. (2) The *groups taught* vary in previous education and experience, in methods of study, in mental capacity, and in present experience, knowledge and skill. The lessons must be adapted to their needs. (3) The *time allowed* for the subject varies. (4) The important *principle of proceeding from simple to complex* cannot in all cases be explicitly followed in the text because of conflicting values. This sequence is determined by the condition of the patient, the resulting knowledge and skill required, and the possible effect of the treatment, rather than by the difficulty of the procedure. For instance, the application of an ice-coil is not very difficult, but it is seldom used, except for acutely ill patients. Applying compresses to the eyes may be simple, but the eyesight may be at stake. Such treatments would be applied by experienced students and taught when the need is felt. Again, the simplicity of the procedure frequently has little relation to the difficulty of understanding the underlying principles. For instance, applying an ice-bag is simple, but to understand the therapeutic action of cold is rather difficult. Again, there are certain things which, although quite difficult, must be taught early because they can be learned only by experience in doing. For instance, while students must study the text on cardinal symptoms, no amount of study in a book will give the *feel* of the pulse necessary to recognize and interpret its character and significance. Such treatments are taught early to allow opportunity for experience. Keenness in observation also comes only with long experience, so practice must begin early. For such lessons, teaching and learning must be distributed over a longer period, whereas in other lessons these may be condensed.

Many educators believe that in an art like teaching or nursing, a real understanding of difficult underlying principles and theories comes only with experience in observation, participation, and responsible practice. For this reason a thorough study and review should both correlate and follow experience in order to insure a thorough mastery of both knowledge and skill, and proper attitudes and appreciations.

While all the above factors constantly have been considered, as far as possible, in the text, it should be used in a flexible manner, keeping in mind the variations in setting, in groups taught, in the time available for the subject, and the basic principles which govern the learning process.

Fifth, to make such additions and alterations as to render the text thoroughly in accord with well established modern nursing, medical and educational theory and practice. The first chapter, which aims to develop proper attitudes and appreciations, and to orient and direct the attention of the student to the spirit, knowledge, skill, and qualities of character essential in her chosen profession, has been almost completely rewritten. This point of view, which motivates and shapes the student's future work and endeavor, is a determining factor in learning. The chapter on "Observations in the Prevention and Cure of Disease" has been rewritten and extended in view of the increasing scientific aspects of nursing, the responsibility of the nurse, and the importance of observation in all scientific work. The chapter on "Inflammation and Congestion," the pathological lesion which forms the basis for all treatments discussed, has also been rewritten. Such topics as communicable diseases, diabetes, anemia, vitamins in feeding, and heliotherapy, have been revised and brought up to date. The figures in the chapter on bandaging have been completely redrawn. Increasing emphasis has been given throughout on nursing in relation to health and to prevention, and to the social and economic aspects of disease.

The writer desires again to express her indebtedness to Miss Isabelle Stewart and to Miss Evelyn Carling for reading the original manuscript, and to Miss Gladys Warburton for her unfailing interest and help with the manuscript and proof. The author also gratefully appreciates the helpful interest of many colleagues and coworkers in both the nursing and medical professions. Indebtedness is also gratefully acknowledged to the various authors mentioned in the text and to the publishers for permission courteously extended to quote from copyrighted books.

BERTHA HARMER.

PREFACE TO FIRST EDITION

The aim of this book is first to impress upon the student the fundamental principles of nursing, founded upon the ideals of service, its object being not only to help cure the sick and heal the wounded but to bring health and ease, rest and comfort to the suffering mind and body. Secondly, to *emphasize the underlying principles* of each practical procedure or treatment in addition to giving the method of procedure or technique. Only by a thorough education along these lines can the student reap the full richness from her profession or give to the patient the sympathetic, intelligent and skilled care necessary to his welfare and recovery.

The text covers the fundamentals in nursing, namely, the nursing care and treatments used in general medicine and surgery which are usually taught in the first and early part of the second year, the rest of the student's training being devoted to the special branches of nursing. The nursing care and treatments used in diseases of the eye, ear, nose and throat are also fully discussed, because such care is frequently required in the general care of patients.

The technique given is based *not* on that of any *one* hospital but on *underlying principles* so it may be adapted to any condition or field of nursing, private or public, and to any hospital without interfering with one already established.

The writer has attempted to give, in one volume, the results of a rather long and varied experience in teaching both theoretical subjects and practical nursing in the classroom and in the wards of more than one hospital as head nurse, supervisor, or instructor, together with a wealth of material drawn from numerous reference books to which the average pupil does not have access.

The text is presented from the teaching standpoint. The material is divided into elementary and advanced nursing and an effort has been made to follow an order, used in most hospitals, which will not only meet the needs in the ward but will carry the student along in a logical order from the simple to the more difficult procedures which require not only more skill but a wider knowledge and experience.

The material is also divided into the two main divisions,—the nursing care and treatments used in medical diseases and those used in surgical diseases. This is the natural division of diseases which the nurse meets both in private nursing and in the hospital, since in private nursing a patient is in the care either of a physician or surgeon and in the hospital is nursed in either a medical or surgical ward. Lectures to students in medical diseases are given by a physician, those in surgical diseases by a surgeon. It is hoped that this order of presentation will help in correlating the classes in practical nursing with the various lectures given and with the experience of the students on the wards. Also that it will eliminate much time, energy, and distraction in note-taking so that more time may be devoted to reports and discussions of the actual life on the wards. It is also very important that the study of practical nursing should, as far as possible, keep pace with the study of the various sciences.

Particular attention has been given to the illustrations, 154 in number, consisting of photographs, diagrams and cuts.

The writer is greatly indebted to Miss Isabelle Stewart, Professor of Nursing and Health, Teachers College, and to Miss Evelyn Carling, B.S. (Teachers College), Assistant Directress of Nurses, St. Luke's Hospital, New York, for reading the manuscript and for the very valuable criticisms given. I am also indebted to the various authors mentioned in the text, to Willard Bartlett, A.M., M.D., F.A.C.S., author of "After-treatment of Surgical Patients," to Frank Sherman Meara, M.D., Ph.D., author of "The Treatment of Acute Infectious Diseases," and to Miss Dorothy Reynolds, St. Luke's Hospital, for the original drawings in the chapter on bandaging.

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Treatments to the Eyes: Examination of the Eyes; Instillation of Drops; Application of Compresses; Irrigations of the Conjunctival Sac; Eversion of the Lower Eyelid; Eversion of the Upper Eyelid; Application of Ointments, Powders, and Solutions; Removal of Foreign Bodies from the Eyes; Burns of the Eyes; Care of Artificial Eyes. Treatments to the Ear; Examination of the Ears; Irrigations of the Ear; Myringotomy; Incision of Furuncles in the Aural Canal; Removal of Cerumen and Epithelial Plugs; Removal of Foreign Bodies from the Auditory Canal; Symptoms to be Watched for When Nursing Patients with Otitis Media. Treatments to the Nose and Throat: Examination of the Nose and Throat; Sprays; Gargles; Throat Irrigation; Inhalations; Nasal Irrigation; Intubation; Tracheotomy.

PART I

LAYING A FOUNDATION IN NURSING AND ELEMENTARY NURSING

FUNDAMENTALS IN NURSING

THE PRINCIPLES OF HYGIENE AND PREVENTION APPLIED

HEALTH TEACHING

NURSING THE MILDLY OR CHRONICALLY ILL AND CONVALESCENT PATIENT

THE PRINCIPLES AND PRACTICE OF NURSING

CHAPTER I

INTRODUCTION

THE OBJECT OF NURSING, WHAT IT IS, AND WHAT IT INCLUDES

We have chosen nursing as our profession and are at the beginning of the course of study which is to prepare us for this, our chosen work. Let us begin by considering the following questions: (1) What is nursing and what is its object? (2) What are the essentials in nursing? and, (3) How and where may these essentials be acquired?

1. What Is Nursing and What Is Its Object?

To have an object or purpose is essential in nursing as it is, likewise, in living a normal healthy life. It becomes a goal to strive for, a guiding purpose by which we measure what we are, what we do, and what we achieve. An object serves not only as an end but as a means, for it becomes a central controlling idea or force which draws to serve its purpose and links together everything useful in our studies and our experience by showing us their bearing and the relation between them. For if we have a definite object in view, we are naturally interested in whatever leads us toward it, and in what we are interested we eagerly pay attention to and derive both pleasure and profit from it. Thus we learn, not without effort—for nursing demands our highest efforts—but with that effort which brings a glow of satisfaction in achievement and work well done. "The imagination of great men feeds upon difficulties and exercises itself upon overcoming them."

What, then, is nursing and what is our object in nursing? Nursing is rooted in the needs of humanity and, like all professions, is founded on the ideal of service. As Dr. Osler has said, "Nursing as an art to be cultivated, as a profession to be followed, is modern; nursing as a practice originated in the dim past, when some mother among the cave-dwellers cooled the forehead of her sick child with water from the brook, or first yielded to the prompting to leave a well-covered bone and a handful of meal by the side of a wounded man left in the hurried flight before an enemy." As the needs of humanity changed, with different times and conditions, out of this same impulse to serve, nursing developed wider interests and functions. So we find in the dictionary that nursing has a wide range of meanings which, however, fall into the following three groups according to the basic ideas expressed. Nursing means, (1) "to nourish," "to cherish," "to protect," "to support"; it means "to sustain," "to conserve energy," "to keep in good health," and "to avoid injury"; (2) It means "to train," "to cultivate," "to educate," and "to supply with whatever promotes growth, development, or progress"; (3) "to give curative care and treatment to the sick and infirm." These three groups of meanings embody the underlying principles which form the object and direct the practice of modern nursing. These are, (1) The preservation of health and prevention of disease; (2) Health teaching; and, (3) The treatment and cure of disease.

Many years ago, Florence Nightingale, the founder of modern nursing, laid down these principles and advocated the preparation of "health teachers." She also taught "that all disease, at some period or other of its course, is more or less a reparative process"; and "that the symptoms or the sufferings generally considered to be inevitable and incident to the disease are very often not symptoms of the disease at all, but of something quite different—of the want of fresh air, or of light, or of warmth, or of quiet, or of cleanliness, or of punctuality, and care in the administration of diet, of each or of all of these,"—in other words, in the want of good nursing, for nursing is concerned with and includes all of this.

To-day, Dr. Hare, an eminent authority in the treatment of disease, in the directions given to his students, says: "In the treatment of all forms of disease the physician must never forget the following influential factors in the case, which are often of greater importance than the measures devoted to the treatment of the disease itself:

(*a*) The maintenance of vital resistance by proper feeding.

(*b*) The elimination of effete materials by the kidneys, bowels and skin.

(*c*) The relief of annoying symptoms which sap the patient's vitality and often obscure the true state of the system.

(*d*) That sufficient physical and mental rest and sleep are obtained if possible." To these might be added:

(*e*) That sufficient physical and mental exercise, suited to the needs of the individual, are obtained if possible.

Nursing is concerned with and includes all of these. For these are all influential factors in the treatment of disease because they are all essential in the preservation of health and the prevention of disease.

Nursing as a Service to the Individual Patient.—Nursing includes: (1) The care of the patient's surroundings and of all things which add to his welfare and promote his recovery; (2) A scientific study (called a case study) of the relevant facts—social, mental, and physical—necessary for an understanding of the patient's needs and as a basis for a constructive program of nursing care. This will include keen observation of the patient's mental and physical health habits, his wants and desires; (3) Keen observation of the symptoms of disease and the results of medical and nursing treatments; (4) His personal care—bathing, feeding, making comfortable and attending to his personal wants, spiritual, mental and physical; (5) The administration of special diets, drugs, and treatments prescribed; (6) Assisting the physician—preparing for and assisting with examinations, treatments, tests, operations; (7) Keeping scientific records—reporting and recording the condition of the patient, his symptoms, and the results of medical and nursing care and treatments; (8) Teaching—in the hospital, the older students, by example, teach the younger students, and each student, consciously or unconsciously, teaches the patients (especially children) the standards of personal hygiene. In the hospital, also, as in all public health work, the problem of the prevention of disease must be attacked on an educational basis. Nursing, therefore, includes the teaching of proper habits of living in relation to food, rest, exercise, sleep, recreation, and all the conditions which insure health of body and mind, and increased resistance to disease. Teaching includes the preparation of special diets, the giving of insulin, making infant feedings, bathing and feeding the baby, and other necessary home nursing measures; (9) Meeting the family and social needs of the patient, apart from which his own needs cannot adequately be considered. This includes consideration extended to the relatives and friends of the patient. He should be relieved, as far as possible, of all family, social, and economic worries which interfere with his present recovery and restoration to health. This will include any necessary provision for the period of convalescence and instruction regarding his future health and care. In the hospital, such important matters will usually be referred to the Medical Social Service Department or to the proper medical or social agency in the community. If a student nurse has established sympathetic relations with her patient she will soon learn, without intruding on his privacy, if such conditions are worrying her patient.

Nursing as a Social and Public Health Service.—As previously stated, the patient can never be rightly understood or adequately cared for considered apart from his family and community relationships; for whether he be in the hospital, his home, at work, or in school, he is still a member of his family and community. The nurse is therefore concerned not only with the care of the individual patient but with the family, the community, and the health of a people. More and more, nursing is becoming associated with and, as a profession, an important link in the chain of agencies which strive for the preservation of health, the prevention of disease, and the general social welfare. The influence of the nurse is spreading far and wide and deep into the hearts and problems of a people. For the nurse, in her capacity of healer and health teacher, is serving the community as a public health and social service worker, whether this service is rendered in community institutions, such as hospitals, or in the broad field of community nursing without the hospitals—as in "specialing," or "visiting" nursing at the bedside of the sick in the homes of rich and poor alike; in school nursing, industrial nursing, municipal nursing, rural nursing, in the Army, Navy, or Red Cross Service, in medical social service, and in various other activities. An eminent critic has said that the final test, as portrayed in the last Day of Judgment, is a social test—"did ye visit the sick, the poor, the hungry?" Nursing includes all of this: each activity is a phase or expression of one great purpose, its object being, as in all professions, *service to humanity.*

2. What Are the Essentials in Nursing?

The *spirit,* the *art,* and the *knowledge* or science of nursing are the three essentials in nursing. While the greatest of these is the spirit—the spirit of service, the love which conquers all things including knowledge and skill—each is essential and each is dependent upon the other just as the root, leaves and flower of a plant develop from the same seed and in turn give birth to new seeds.

Leonardo da Vinci, one of the supremely great of all time, both as an artist and as a scientist, has said that, "True and great love springs out of great knowledge, and when you know little you can love but little or not at all"; and one of the most profound thinkers of our time has said that, "There is only one road to progress, in education as in other human affairs, and that is: science wielded by love." All fine art and all good workmanship, worthy the name of art, are expressions of this spirit of love and of knowledge. So in nursing, if a student nurse will cultivate these three essentials—the spirit, knowledge, and art—each will grow and unite to become a service like, as it were, to the mighty oak—deeply rooted, lofty, broadly spreading, sheltering, enduring, living and growing, beautiful and fruitful.

(*a*) **The Spirit of Nursing—Our Attitudes, Ideals and Standards of Work.**—As stated above, nursing springs from the ideal of service, love and brotherhood, of service to those in trouble, sorrow, sickness or pain, and in the time of death. The nurse is responsible to the patient in a peculiar sense. For there is no person, except possibly the physician and clergyman, who touches so closely the inner life of the people. The nurse is with them when all the conventions of life seem trivial, when all the barriers of reserve are broken down, and the innermost cherished and secret thoughts, hopes and fears stand revealed. *Sympathy, kindness,* and *unselfishness* are needed; but also something more—something deeper and more helpful, more loving and spiritual—which supports the patient and gives him a feeling of strength, security and comfort. The utter helplessness of the patient and dependence upon us appeal to and develop in us the maternal and protective instinct.

Now, while all may have this spirit of sympathy, kindliness and helpfulness, even to the degree of self-sacrifice, at the beginning of training, it must be very carefully cherished and developed. If we neglect it and, day by day, in the rush, strain, and fatigue we feel impatience and indifference, we may become incapable of feeling and hardened. Nurses have sometimes, with justice, been accused of this. We must weed out such harmful thoughts and encourage kind thoughts and actions. No one becomes kind except by being kind, and no one can win this spirit of love and service unless they, day by day, do acts of kindness. In no other field, perhaps, is there such light and warmth and inspiration, such a rich opportunity for fullness of development. Dr. Osler has said: "There is no higher mission in life than nursing God's poor. In so doing, a woman may not reach the ideal of her soul; she may fall short of the ideals of her head; but she will go far to satisfy those longings of the heart from which no woman can escape." It is distinctly a woman's work—the one profession in which women are admitted by all to excel men.

A *cheerful optimistic spirit* is also very helpful both to the patient and the nurse. While the hospital is often a place of sadness, it is not often one of gloom but often one of rejoicing. Gloom is most depressing to the mind and reacts very unfavorably on the patient's progress. Cheerfulness and optimism act as a tonic, or like sunlight which is now recognized as one of the great healers. Cheerfulness must not be confused with frivolity or thoughtless mirth which disregards the sorrows of others. Sick people are very sensitive to the actions and presence of those around them. So it is our part not only to do the right things but to enjoy, to look and act as though we enjoyed. For happy persons bring new courage and give a new hold on life, and this is valuable as the patient must help himself to live. His mental attitude is therefore most important. A nurse can do much to cultivate this spirit both in herself and in her patient. In addition to the above the following qualities are desirable:

The *Spartan spirit* which will not flinch from duty, which makes light of discomforts and dangers, and welcomes hard tasks; which avoids an antagonistic attitude but is firm and unyielding in the face of duty.

A *spirit of appreciation* of the work and all that it signifies. This includes: (1) An esthetic appreciation, as in seeing a beautiful piece of finished work such as a beautifully made bed or a patient who looks "the picture of comfort"; (2) An appreciation or delight in the actual doing of skilled work; (3) An appreciation of human nature, of the value of human life, of the greatness and weakness of humanity, of all its virtues and trials—one rejoices in the recovery of the patient, in his triumph over sickness; (4) An intellectual appreciation in the sciences, in the study and knowledge of disease and of how to combat and prevent it. Appreciation in all its phases should be developed. For it makes one fall in love with, become absorbed in, and thoroughly enjoy one's work. But one must avoid the danger of developing one at the expense of the other. For instance, our delight in making a bed quickly and skillfully, and our pleasure in seeing it beautifully finished, if overstressed may make us forget the patient in the bed so that he will be quite unable to appreciate it, however beautiful. Again, our intellectual pleasure in learning may cause us to regard the patient as a "case," forgetting that he is a human being. "The intellectual faculties of memory, judgment and criticism in studies, leave the learner cold—he knows, but it does not make any difference to him; he lacks sympathy and understanding."

It has been said that "a man's conscience is not the producer but the product of his career" and, "as ye sow ye shall reap"; so that habits of sympathy, of kindliness and patience, of thoroughness, persistence, and punctuality have a real moral value.

A *democratic spirit* which leaves class and race prejudice behind. It is the aim in the hospital to give the same kind of care to men, women and children, to all colors and creeds, rich and poor, enemies and friends.

A *scientific spirit* which promotes a love of truth and avoids exaggerations and vague, misleading statements or actions; which is not influenced by sentimentality, which promotes a wholesome spirit of inquiry and investigation but never loses a feeling of wonder and reverence for the human body. Other necessary attributes are: patient industry, persistence, ability to concentrate on difficulties to be overcome, precision, accuracy, a creative imagination, and an urge for expression—to do or to make something. These qualities develop both the art and knowledge of nursing, for art and scientific knowledge are said to spring from the same root and to be developed by the same qualities.

A *spirit of progress*—a definite goal, a desire for self-improvement, and a critical attitude toward one's own work which may be measured by the following standards of work:

Standards of Work:

(1) The safety of the patient, the nurse and others.
(2) The therapeutic effect of the treatment or service, and the speed and completeness of the patient's recovery.
(3) The comfort and happiness, freedom from suffering and worry for the patient and relatives.
(4) Economy of effort, time, and materials in nursing.
(5) Artistic, finished appearance of work.

(*b*) **The Knowledge or Science and Understanding of Nursing.**—The following forms of knowledge are essential in nursing:

(1) That imaginative knowledge, bred of a deep sympathy for others, which gives one an insight into and an understanding of the thoughts, feelings, and needs of people, and which brings a sense of duty and responsibility based on this knowledge. This is the highest form of knowledge. Like all knowledge it can be learned and cultivated by study, by practice, by knowledge of ourselves, our own weakness and strength, and by the observation of others.

(2) Knowledge of the basic sciences and related subjects included in the curriculum.

(3) Knowledge of health, and of disease, its treatment and prevention.

(4) The science or knowledge of nursing, itself—*what* one should know.

(5) Knowledge of *how* to do things—the technique of nursing.

The course in nursing is the heart of the whole curriculum, the object for which all the other courses are given. Such subjects as the basic sciences form a background (just as they do in medicine and other arts) from which we draw facts and underlying principles and apply them to nursing. This application of science to nursing (making nursing an applied science) is essential if nursing is to be intelligent and safe, for an art without science is said to be a boat without a rudder. Such subjects give us tools to work with; they stimulate, inspire, and excite our interest; they direct and focus attention; they throw light and reveal facts and principles in our experience which would otherwise remain unnoticed or misunderstood. But all the time spent in the study of such subjects, however necessary, interesting and instructive they may be in themselves, is merely a preparation for the study and practice of the art and science of nursing.

A Scientific Method Essential in Nursing.—A scientific method of work, as well as a scientific spirit, is essential if nursing is to be an applied science. Students may observe this method in the science laboratories, and, in the clinical laboratories or wards, they daily assist physicians in applying this scientific method in the diagnosis and treatment of disease. This method, as applied in medicine, is called the "case method" of study which, as previously stated, should likewise be applied in nursing, in order to have an understanding of the patient's needs and a basis for a constructive program of nursing care.

Education is to help students to help themselves. From this standpoint, the habit of using a scientific method of work is perhaps the most important and useful tool which students can acquire. It helps one to adjust to new situations and to solve new problems (and our ability to do this is the measure of our intelligence and our success), for it is equally applicable and useful in all independent, constructive work in all branches in the field of nursing.

(*c*) **The Art of Nursing.**—The art of nursing is the means by which the spirit and knowledge of nursing are expressed. It is the *doing* side of nursing which, with patient intelligent practice, becomes an art, growing and changing with advancing knowledge and becoming one with the science of nursing. To acquire this art, training and development of the following qualities and faculties are necessary:

(1) Health of mind and body. This gives a wholesome, cheerful, sane outlook, steady nerves, a mind and body well under control and the strength and endurance necessary to give the best care to the sick.

(2) The ability to adjust to new situations, to interpret and meet the needs of patients, to get along with and to be liked and respected by patients and associates.

(3) Manual dexterity is essential. The hands must be deft, strong, capable and sensitive to impressions. The touch must be gentle and light, but steady, firm and sure, never nervous or hesitating.

(4) Trained senses (eye, ear, sense of smell, taste and touch), quick, keen, accurate observation, alert for signs which note improvement or danger; all the windows and doors of the mind open, and a mind trained to respond immediately in the right way.

(5) Nerves cool and steady, a mind quick in seeing and grasping things, resourceful, well-poised, quick-witted, undismayed by the unexpected, ready for emergencies.

(6) Initiative, foresight, judgment, good sense and reasoning powers, decision, and fine discrimination.

(7) A good memory, exact and reliable, which depends largely upon interest, attention and training.

(8) A real interest in people, a desire for their welfare and the faculty of making this felt; tact, coöperation, the ability to handle people and get along with them—if this is lacking, all the other virtues, capacities and knowledge may be of little value. One must learn to understand and influence people.

(9) A manner pleasing, discreet and courteous, soothing, not irritating, winning the confidence of friends and patients.

(10) Expression—ability to control one's emotions, the expression of the face kindly, serene, impassive, the voice quiet and gentle; also the ability to express, either in writing or orally, clear, concise, accurate statements unvarnished by sentiment.

(11) Reliability and trustworthiness in the care of patients and in carrying out instructions, which inspires the confidence of patients, friends, doctors, and instructors.

(12) A sense of responsibility not only to the patient but for one's own health and progress in learning.

(13) Executive ability which requires foresight, ability to organize, getting things done on time, subordinating nonessentials

to essentials, keeping a number of things in hand at once, running smoothly with no excitement or confusion—the ability of managing affairs and people.

(14) Obedience and willingness to be guided by those responsible for the care of the patients, and by those responsible for and striving for the interests and education of nurses.

3. How and Where May These Essentials Be Acquired?

For the course in nursing, as in all courses in pure or applied science, proper classrooms, laboratories, and instruction are essential. *Classroom teaching* saves time and makes organized, systematic, well-rounded instruction possible; it supplies facts and underlying principles and thus gives us tools to work with; it reveals, interprets, and organizes knowledge gained in the wards so that all students may share alike; it stimulates and excites the interest, directs the attention, and frequently inspires. *Laboratory teaching* provides for demonstrations by the teacher, for shared experiments by teacher and students, for individual or group experiments by students following spoken, written, or visual (demonstration) directions, or for independent student experimentation and practice in accordance with her interests and needs. It teaches students to think and work independently, to note the relation between cause and effect—how and why good or bad results are obtained—to check results and draw conclusions, and to measure their progress in terms of her own capacity and with the group as a whole.

Clinical Teaching and Supervised Experience.—Such classrooms and laboratories may be in a hospital or in a college or university. But in nursing, as in medicine, something more is essential, for there is only one classroom where students may learn the difficult art and science of nursing and that is in the wards and clinics of a hospital, and in a community nursing service, which provides the necessary clinical teaching and supervised experience, or which is affiliated with a school which rounds out this experience. For it is only through clinical teaching and supervised experience that students may observe, study and care for the necessary number and variety of patients, of diseases, of treatments, of nursing measures, and where they may develop scientific methods of work and the knowledge and skill necessary to cope with the problems represented in the family, social, mental and physical conditions presented both in the hospital and the community.

The time spent by the student in the wards in the care of her patients is the most valuable, the most memorable in her training, for there is a wealth of priceless knowledge to be gained in the study and care of the patient. A student can gain knowledge regarding his history, social background, symptoms, the tests used in diagnosis, his medical and nursing treatment and its results. This is a study fascinating and stimulating to the mind, the imagination and the sympathies, and is capable of developing a large-mindedness, a breadth of view and purpose not found in other fields. It is here that the student develops not only in knowledge and skill, but develops also in sympathy, judgment, self-control, and in all the other qualities so desirable and necessary in a nurse. It is here, too, that the student learns to tackle and solve problems efficiently, for this ability, like every other ability, can only come through practice and training in doing. It is here, then, that the student becomes equipped to become a useful member of her profession and of society; for, "education must proceed through the eyes and hands to the brain," and a nurse is judged, not by what she knows but by what she does. As Ruskin says: "Education is not to make people know what they do not know, but to make them behave as they do not behave." If students would remember this, we should not hear complaints about the "overtrained" nurse, or of the nurse "good in theory but hopeless in the wards." Every one (children and grown folk) admires, respects, and has confidence in a person who can do things. It gives one influence and power and this power can only come from practice in doing.

In after years, the part which stands out in the memory of the nurse is the unforgettable knowledge gained in her experience in the wards. She feels that she has a firm grasp of such knowledge which can never be taken away from her, and which cannot be bought or found in books. Knowledge which is in books may be learned at any time, but the experience in the wards can never be repeated; every moment is precious.

All the time spent in the classroom, in the study of the sciences, etc., however interesting and instructive in themselves, is merely a preparation for the vital work in the wards. The wards are the workshops where tools acquired in the classroom are brightened and sharpened by use, and the only sure test of such knowledge is in its application and use in the care of patients. As. Dr. Osler used to say: "To study the phenomena of disease without books is to sail an uncharted sea, while to read books without patients is not to go to sea at all."

Without the knowledge and underlying principles studied in the classroom, to care for the patients in the wards is to "sail an uncharted sea" without a guide, helm or rudder. The practice is unsafe, the knowledge gained meager, haphazard, and unsound, and there is no adequate provision for initiative, for growth or for future constructive work.

Teaching Supervision is essential for two reasons: first, for the adequate care of patients; and second, for the education of students. Each of these is dependent upon the other, for the proper education of students insures the proper care of their patients and *vice versa*.

As the nursing is usually done by students, all of whom are in the process of learning, supervision of the nursing, for the above reasons, is absolutely essential; for, how can the blind lead the blind and how can students learn without a teacher? Even the best of us need to be spurred along at times and are glad to have standards kept before us which we are obliged to keep.

The hospital has accepted a sacred trust in the care of patients who have confidence in and are entirely dependent upon the hospital, doctors and nurses. The reputation of the hospital and the welfare of the patients depend upon the quality of the nursing, and this depends to a large extent upon adequate supervision by qualified supervisors. Pupils are apt to misunderstand and to resent this supervision whereas they should demand it as their right. They should recognize that this constant checking up is what upholds the standards of the school, which attracted them to it and which gives them reason to be proud of it. It is stated that much of the success of any school system depends upon the quality of supervision, and that expert constructive supervision is the most potent force, acting as a pressure on every one to become stronger, more useful and efficient.

Students frequently forget, misinterpret, or fail to apply what is taught in the classroom. The classroom teaching must, therefore, be followed by teaching supervision in the wards. For, "Behold, a sower went forth to sow, and when he sowed, some seeds fell by the wayside, and the fowls came and devoured them up; some fell upon stony places where they had not much earth, and forthwith they sprung up, because they had no deepness of earth: and when the sun was up, they were scorched and because they had no root, they withered away. And some fell among thorns and the thorns sprung up and choked them. But others fell into good ground and brought forth fruit."

Students also frequently fail to understand that the real course in nursing begins with the clinical experience in the actual care of patients; and that here they constantly need a teacher to demonstrate, to interpret, to direct, to explain, and to help them to apply principles studied in the classroom.

The value of the supervision given will depend quite as much upon the student nurse as upon the supervisor. Supervision to be successful can never be one-sided. No matter how well-informed and thoroughly equipped a supervisor may be to give advice, assistance, and instruction, and no matter how sympathetic and willing she may be to share her invaluable experience —her time and energy will be largely wasted, her results will be most disheartening, her efforts and good intentions will be entirely misunderstood, and the student will profit very little, if the student, herself, does not feel the need of guidance and instruction, and look to the supervisor for it. Supervisors do not go about in the wards among the patients as inspectors or policemen to interfere, to find fault, to give orders, or to deprive the students of freedom, but as experts in the interests of both patients and students, ready to serve the patients dependent upon the nurses for their care, and to serve the students who have come to the hospital to be trained and educated in the difficult art and science of nursing.

Necessary Steps in Learning.—All of the above essentials—the spirit, knowledge or science, and the art of nursing—cannot, and should not, be learned at once. The student goes through definite stages of learning, each of which prepares for the work which is to follow. These stages of learning, and the student's progress to the completion of her course, are not rightly determined by the difficulty of the various procedures or the technical aspects of nursing, but rather by the *condition of the patient* and the personality, knowledge, and skill required to best meet his particular needs and the difficulties encountered in the whole problem of his complete care and welfare. One might be skilled in all the *procedures* but fall far short in the art of nursing. For there are spiritual and intellectual aspects of nursing, of great therapeutic value, in which the procedures or technical phases play little or no part.

The basic course in nursing is usually divided into a selective or probationary period, and periods corresponding to the sophomore, junior, and senior years of college. During the first period the student becomes familiar with the hospital—its relation to the community, its various departments, their relation to each other and to the whole—and with the part she is to play in this great scheme of physical, mental and social betterment. During this and the following period the student lays a foundation in nursing by acquiring the fundamentals in nursing, the principles of health, and the art of nursing which pertains to the care, comfort, and treatment of the convalescent, the chronically ill, and the patients not acutely ill. She may also assist in the care of the acutely ill and in this way gradually acquire the art which nothing but experience can teach.

This period is one of adjustment during which the student both tests and is tested by the school as to the wisdom of her selection and fitness for the profession. During the first and, perhaps, part of the second clinical periods following she becomes proficient in the care and treatment of medical and surgical diseases,—the remaining part of her training being devoted to the special branches in nursing and to experience in that branch to which she seems particularly adapted.

This book follows the student in her studies and experience through the first preliminary term, and the first and part of the second clinical terms only.

CHAPTER II

THE HOSPITAL IN THE COMMUNITY HEALTH PROGRAM

FUNCTIONS OF THE HOSPITAL

1. The Hospital as a Home for the Care and Cure of the Sick.—A person who is ill may be cared for in his own home, in the home of another, on the battlefield, in a hotel, or in a hospital.

The word hospital comes from *hospes,* which means host, and so a hospital embodies the idea of hospitality from a host or hostess to her guests. Hospitals were originally guest houses for the shelter and entertainment of travelers, the words hotel and hospice coming from the same word.

Wherever it may be, the principles and laws which govern the maintenance of health and vital resistance, and the prevention and cure of disease are the same. As the principles are the same the methods used are also the same, with modifications and adjustments to meet the different situations. Each situation may have certain advantages but also its limitations. For instance, the home may surround the patient with family devotion and undivided attention but may be lacking in hygienic conditions, in equipment and facilities, and in the trained personnel found in a hospital. A nurse, trained and educated in underlying principles, will adjust to each by bringing to the home the knowledge, skill, scientific methods and efficiency of the hospital; and, in the hospital, will try to give to the patient, as far as possible, the personal interest and devoted attention of the home.

2. The Hospital as a Social Health Center—Family and Social Aspects.—The word "home" suggests a family and community. It has long been recognized that in the *diagnosis* of disease knowledge not only of the patient but of his family, his community, and his life and work is necessary. More recently it has been recognized that these family and social aspects play an important part in the *treatment* of disease and cannot be separated from the medical aspects without loss to the patient, and to medical and nursing knowledge. In the treatment of hereditary and communicable diseases the family and social aspects are obvious; they are becoming equally obvious in the treatment of infants and children, maternity cases, occupational, nutritional, circulatory, surgical, and all other forms of disease. At first these aspects were left to the interest and responsibility of a few specialized social service nurses and confined to selected needy patients, but they are now considered an inherent part in the nursing and medical treatment of every patient. The hospital, because of its many advantages for the study and treatment of disease, social, mental, and physical, and for the teaching of health habits, thus becomes a social health center, a link in the community health and welfare program.

3. The Hospital as a School:

(*a*) For the Patients.—To *teach* is one of the most important duties of all nurses, whether in the home or in the hospital. A public health nurse in the community goes from home to home, or school to school, and nurses and teaches. Whereas a hospital is like a school where the students, as patients, and the teachers, as nurses, are gathered together. The *setting* is different but the function of the nurse as a health teacher, and the principles taught, underlying the prevention and cure of disease, are the same. Patients with tuberculosis are frequently sent to a sanitarium to learn hygienic principles and to establish health habits in regard to rest, sleep, diet, and cleanliness, etc. Patients with communicable diseases, diabetes, and all patients who leave a hospital should not only be cured or improved but should have established hygienic health habits and learned the principles and methods of prevention.

(*b*) For the training and education of physicians and surgeons.

(*c*) For the training and education of nurses.

(*d*) For the extension of medical knowledge.

(*e*) For the extension of nursing knowledge and skill.

(*f*) For the spread of health education and the prevention of disease in the community.

CLASSIFICATION OF HOSPITALS

1. According to Support and Control:

(*a*) *Public*, owned by the city or state, controlled by a commission or board. The patients usually have free care.

(*b*) *Semi-public*, usually built and maintained by a body of citizens, a church society or organization such as the Red Cross. Funds are supplied by public subscription, supplemented by appropriations from civic funds and answerable to the public. Other hospitals may be endowed and receive no support from the city or state. They are also supported by charges made to both public and private ward patients.

(*c*) *Private*, owned by one or more individuals, and usually run for commercial gain or professional advancement.

(*d*) *Military* hospitals, under the medical service of the army, with national support and control.

2. According to the Diseases or the patients treated:

(*a*) *General*, which accepts most types of diseases and patients.

(*b*) *Special*, which may be limited to a certain type of disease as obstetrics, contagious, mental, etc., or may be confined to men, women, or children. Hospitals for the contagious or mental diseases may be under private support and control but are mostly controlled and supported by the city or state. Hospitals for obstetrics may be private, semi-public or public as regards their support and control. General hospitals are usually supported as public or semi-public hospitals.

Nurses should realize the sources from which the funds necessary to run the hospital are derived. In their attitude toward those responsible for running the hospital, toward the hospital itself, the care of equipment and supplies, and toward everything that pertains to the life and work within the hospital they should realize the difficulty each hospital has in securing adequate funds and the necessity for seeing that they are used to the best advantage for the purposes for which the hospital exists.

Situation and Structure of the Hospital

Situation.—Modern hospitals are usually built with careful attention to the situation and surroundings as it is now recognized that these have a definite relation to the nursing care and recovery of the patient. The principles of hygiene and sanitation are the governing factors in both situation and structure.

A hospital should be situated in a convenient place for the reception of patients, but if possible, on the outskirts of the city so that it will have plenty of pure air, free from dust, smoke, odors, etc., and quiet and seclusion from the noise and traffic of the city. If possible, it should be surrounded by well-kept, attractive grounds, with a dignified approach, which gives an air of order, quiet and restfulness, very beneficial to the patients. It should be built on an elevation in order to secure good drainage and plenty of light; not crowded or shut in by other buildings, and with a good outlook, a view of distance, very soothing and restful to the patients. The exposure should be southern or southwest, so as to have plenty of sun but avoidance of cold winds.

Structure.—Modern hospitals are attractive, not harsh or forbidding in outline, built of the most durable, fireproof material. All the wards should be exposed to the sunlight with good ventilation. The interior—floors, walls, ceilings, etc.—should be made of durable material, easily kept clean, and smooth, so that the dirt won't stick, and free from ledges, crevices and decorations. The floors should be nonabsorbent and comfortable to walk on—tile or varnished oilcloth. The building should contain all modern conveniences to save time, labor, and to insure efficiency at the least expense. While the older hospitals may not meet these requirements, the disadvantages may be overcome as the quality of the nursing and their long and honorable service show.

Such ideal conditions are very often not possible but in so far as the nurse can control the conditions, full advantage should be given the patients of fresh air, sunlight, a view from window or balcony of the blue sky, green trees and other growing things.

ORGANIZATION OF THE HOSPITAL

The organization varies but usually includes the following departments:

1. The Administrative Staff—the superintendent of the hospital, clerks, bookkeepers, telephone operators, and other administrative officers. They manage the *business* end of the hospital's duties and take care of the buildings and grounds. The superintendent is responsible only to the Board of Managers and lays down the general policies and coördinates the various services.
2. The Medical Staff—medical experts appointed by the Board, Attending Physicians (externes) and House Physicians (internes) who live in the hospital. Their duties are to diagnose, prescribe and administer treatments, to investigate and study disease and to teach.
3. The Dietary Department with a dietitian in charge who is responsible for the food served to patients and staff, etc. She may be responsible to the Training School Department or directly to the Superintendent of the Hospital.
4. The Housekeeping Department with a matron in charge and maids, cleaners, laundry and linen room workers.
5. The orderlies on the male wards who have certain nursing duties and may also assist in the cleaning and care of the wards.
6. Technical Experts—pharmacist, anesthetist, pathologist, X-ray and electrotherapist, etc.
7. Social Service Department—nurses who investigate the homes of the patients where necessary and see that the home conditions are not such as to interfere with their recovery, and who see that the patients after discharge are able to and do carry out the prescribed treatment.

THE SCHOOL OF NURSING

The nursing service may be conducted by a school of nursing acting as the Nursing Department maintained by the hospital. Or it may be conducted by a separate School of Nursing which, like a medical school, is a department of a university but affiliated with a hospital to provide the necessary clinical education and experience for its students. While not a hospital department, under its support and control, it will be responsible to the hospital for the nursing care of its patients as a medical school is for their medical care. A nursing department may consist of graduate nurses only, with superintendent of nurses in charge. A school will consist of a faculty and students. The faculty will consist of instructors, clinical instructors—supervisors and headnurses—responsible both for the care of patients and for the education of students, and a director who will be both principal of the school and superintendent of nurses in the hospital, responsible to the superintendent of the hospital and the board of managers for the administration of the nursing service.

For the proper administration of the hospital it is essential that every detail of hospital management should run smoothly, that every department should know its own work and carry it on effectively and that the various departments should work harmoniously together. The first thing is to get acquainted with the general scheme, the departments, the officers in charge, the general duties of each, the rules and regulations of the institution, and to learn to find your way about. The next thing is to get thoroughly acquainted with your own job, and learn to do it well. However simple the duties, they are always important to the smooth running of the institution. As soon as these first duties have been mastered new duties and increasing responsibilities will follow.

Remember the whole purpose of nursing and of the hospital—to care for, to cure, to educate the sick and to prevent disease. The Nursing School is responsible to the patient, the hospital, and the community.

outline chap.

CHAPTER III

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY HYGIENIC HOUSEKEEPING

The Ward as a Home for the Sick

The Surroundings of the Patient.—The ward is the special room set aside and prepared for the care and comfort of the guests who are to be our patients. Before the guest arrives his room must be prepared and in perfect order. It must be bright, airy, quiet, spotlessly clean, orderly, everything in its place, and attractive in its simplicity. The patient and his friends should have a feeling of confidence and reliance on the care they are likely to receive. You know that in traveling in a strange country (and our patients must feel lonely, as though they were in a strange country on a long, doubtful journey) when entering an hotel, an appearance such as outlined is a sure index of the quality of the food and the service, etc., and you enter with a sense of relief and security. Whereas disorder, things out of repair, lack of cleanliness and system, and so forth, inspire a feeling of doubt which is very depressing, and which even very good food and service will not entirely dispel. In the care of the sick the nurse is the housekeeper, for housekeeping—the care of the patient's surroundings—is just as truly nursing, and the recovery of the patient is just as dependent upon it as upon the personal care of the patient himself.

The furnishings of a hospital ward should be all plain, substantial, durable, smooth, free from decorations, and made chiefly of iron and glass which are nonabsorbent, easily cleaned, and which soap and water will not injure. They consist only of those articles essential for the care and comfort of the patients. The coloring of the walls and floor is always plain, free from pattern, cool, and restful to the eyes. This very simplicity, freedom from confusion and complexity is very restful to the patient, sick in mind and body, and is one of the essential factors in his recovery.

Daily Care of the Ward.—The important factors to consider are its ventilation, heating, lighting, disposal of sewage, its cleanliness, neatness and order, and the general plan of work.

The daily care of the ward begins with flooding it with sunshine and fresh air, and in "tidying up"; that is, putting it in order. The beds should be neat and in line, the tables and chairs tidy, and in their proper places. All articles not in use should be removed and put in their proper place. The ward should present a picture of order, neatness, and symmetry, for nursing is an art and symmetry is the first essential in all art. After the floors are swept, beds, tables, chairs, screens, radiators, ledges, etc., are dusted and all utensils cleansed. Stand drawers are tidied and dusted, the patients' flowers are watered and arranged, all cupboards are dusted, their supplies checked, and neatly, symmetrically arranged. All utility rooms, bathrooms, linen and blanket closets should receive the same care. Equipment and supplies necessary for the day's work are prepared.

In beginning her duties, the student should have a definite plan of procedure so that her work may be accomplished with system and efficiency, without loss of time or energy. She should also plan her work so as to be able to meet extra demands or emergencies as they arise.

The importance of the above factors—ventilation, lighting and cleanliness, etc.—in the recovery of the patient and the means of providing them, so as to get the best results, are discussed in the following pages.

VENTILATION

Proper ventilation or air control is an extremely important factor in the maintenance of health and in the recovery from disease. Florence Nightingale has said that "The very first canon of nursing, the first and the last thing upon which a nurse's attention must be fixed, the first essential to a patient, without which all the rest you can do for him is as nothing, with which I had almost said you may leave all the rest alone, is this: To keep the air he breathes as pure as the external air, without chilling him." It has been said that "Air is the first necessity of life" and that "seemingly insignificant variations in temperature and humidity are now found to have an extraordinary effect on health in all parts of the world."[1] To insure ideal atmospheric conditions the following factors must be considered: (1) temperature; (2) humidity; (3) movement; (4) variability; (5) purity.

Temperature.—Conclusions drawn from very extensive studies of the effect of temperature on the health and energy of the body—based on the deaths following operations, and during the prevalence of disease and in a wide variety of conditions—show that the best average temperature for day and night is about 64° F., or from 64 to 68° during the day and a little lower at night. Too much emphasis cannot be placed upon this correct temperature, for "If the people could only be made to realize that the difference between 67° and 72°, for example, often means a difference of 5 per cent. in the death rate, they would think it worth while to take pains."[1] It can easily be demonstrated that when people remain for a number of hours confined in a room at 75° F., there is an increase in the pulse rate and a rise of body temperature.

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[1] Ellsworth Huntington, Ph.D., Yale University.

The **humidity** is equally important and varies according to the temperature—the body is very sensitive both to changes in temperature and humidity. The best conditions exist with a temperature of 64° and humidity of 70 per cent. With the temperature 64 (ideal) and lower humidity there is an increase in the death rate from 5 to 15 per cent., according to the drop in humidity. Very dry air makes people feel chilly because it causes so much evaporation one feels cool. Very dry air also makes people very sensitive to draft or movement of air. This causes them to close all the windows and doors, etc., and to demand more heat, not because the temperature is too low, but because the humidity is too low. The air then becomes stagnant and impure. On the other hand, when there is too much humidity droplets of moisture condense in the air, making it raw, cold, and clammy. When the temperature and humidity are just right the air feels soft, warm and spring-like.

At high temperatures (above 70°) an increase in the humidity (above 60 to 70 per cent.) shows an increase in the death rate. At a low temperature an increase in humidity lowers the death rate.

The temperature in the hospital should not be above 68° and the humidity not below 50 per cent. It is estimated that a proper regulation of the temperature would lower the death rate 5 per cent. and a proper regulation of the humidity another 5 per cent.[2]

Movement and Variability, that is, air in motion and with variations in the temperature.—These factors, also, if secured without causing chills, and increased dryness and temperature, are very beneficial to health, and aid in the recovery from disease. It has been estimated that proper air control in this respect would lower the death rate at least 3 per cent. These factors explain why outdoor air is so much more beneficial than indoor air. To quote from Dr. Ellsworth Huntington again: "Keep a patient indoors with a uniform temperature of 68° and with an abundant supply of air which is absolutely fresh and pure, but which has no perceptible movement. Put the same patient out of doors in a temperature ranging from 60° in the morning to 70° at noon. Let him enjoy the fresh air as it sweeps gently across his face; let him feel the sudden little drop of temperature when a cloud obscures the sky, or when a pleasant breeze blows briskly for a minute. For hour after hour let him experience the tingle of strengthened circulation that comes with the constant movement and variation of the outside air. Every one knows that the patient who is alternately soothed and stimulated in this way has a much better chance of recovery than the

[1] Ellsworth Huntington, Ph.D., Yale University.

[2] Ibid.

one who feels the same fresh air, is warmed by the same sun, and looks upon the same scene behind a barrier of windows which prevents perceptible movement or variation. Slight as is the difference between the outdoor and indoor air, its effect is almost magical. The difference lies in the degree of movement and especially of variability, for such variability is a universal quality of outdoor air in all good climates."

You have, no doubt, noticed that when a baby (or anyone) sleeps indoors his face usually becomes very hot and flushed looking and that he sometimes wakens very irritable. This is because while asleep he remains absolutely still so that the heat and moisture, constantly given off from his body, warms the air around it so that he is covered, as it were, with a hot moist blanket which becoming hotter than the body prevents further loss of heat and moisture because there is not enough movement in the air to carry away the hot oppressive air. When sleeping out of doors the movement and variability of the air insures a longer, healthier sleep from which one wakens refreshed.

This movement and variability, together with sunlight, explain why soldiers in time of war, cared for in open tents, have frequently made such marvelous recoveries although deprived of proper food, medicines, treatments and nursing care which in the hospital are so essential. Modern hospitals and dwelling houses alike are now built with gardens, balconies, sunrooms and sleeping porches so that sick and well may have as much of the healing outdoor air and sunlight as possible.

Pure Air.—Pure air means air free from gases and other products of combustion, free from dust which consists of inorganic and decaying organic matter, excretions from men and animals, molds and bacteria, etc.; free from impurities—gases and organic matter in the expired air from man or animals.

Dust in the air is very irritating to the mucous lining of the eyes, nose and throat, causing abrasions, lowering the resistance and making them liable to infection. "Air is essential to life" and the essential factor in it is oxygen, which is necessary for the chemical changes which go on in the body, upon which life depends. The air inhaled consists of 20.81 per cent. of oxygen and 0.04 per cent. of carbon dioxid. After the exchange of gases which takes place between the air in the lungs and the blood, the exhaled air contains 16.03 per cent. of oxygen, 4.38 per cent. of carbon dioxid, organic substances, heat, and moisture. It is the heat and moisture given off, increasing the temperature and humidity of the air, which is injurious, rather than the impurities exhaled. However, a sufficient amount of air space (at least 2000 cubic feet) must be allowed for each patient. If the amount of oxygen falls to 13 per cent. one feels discomfort in breathing; if it falls as low as 8 per cent. one has great difficulty in breathing and asphyxia or smothering shortly follows.

It is estimated that pure air would lower the death rate about 2 per cent.

Methods of Securing Proper Air Control:

1. The situation of the hospital, its structure and the relation of its buildings—the wards away from the laundry, power house, garbage disposal, stables, kitchens, etc.—are all planned to secure ideal conditions.

2. The number and arrangement of beds so that each patient will have the required amount of air.

3. Modern hospitals are supplied with the indirect heating system by which, if properly managed, ideal conditions may be secured both summer and winter—the air being warmed in winter, cooled in summer, moistened, freed from impurities and forced into the room by fans, giving also movement and variability. By this method air treated with a disinfectant may be forced into the room.

4. Whatever the system of heating, there should be thermometers in each ward (several in large wards) and the temperature should not be allowed to go above 68° without steps to lower it. According to the system used, windows may be opened, the heating system regulated by the local regulator, or by reporting to the proper authorities. A temperature chart should be kept with as much care, for it is equally important, as the temperature chart of the patient.

5. The humidity should not be below 50 per cent. Humidity is secured by evaporation—for instance from a kettle of boiling water on a stove or from pans of water on steam or hot water radiators.

6. To secure movement and variability keep the window open a little at the top. Open the windows every two or three hours and keep them open until the air cools 3 or 4 degrees. Open at both top and bottom having a deflector or board at the bottom to direct and control the current of air in order to prevent drafts. The warm air, and with it impurities, rises, so that the upper air is both hot and impure,—this will pass out the open window at the top while the cooler air will enter at the bottom, causing an entire circulation through the room.

7. While the room is being ventilated see that the patient is not in a draft and that he is properly covered with extra blankets if necessary. Place a screen between the window and the patient. Have him take deep breaths of the cool fresh air. Even greater precaution should be taken with a patient who is allowed up, for when a patient is in bed, properly covered and protected, there is little danger. But when up, his strength is probably being taxed to the utmost, his resistance is low, it is much more difficult to cover and protect him sufficiently so he is very apt to "catch" cold. It is not necessary for the air to be cold in order to be pure. If it is not desirable to open the windows in the patient's room, it may be ventilated by opening the door into an adjoining room which has been properly ventilated. It may be heated so that warm air enters the patient's room. See that the door does

open into a well ventilated room and not into a stuffy room or passage or into a courtyard where the air is stagnant.

8. To prevent impurities in the air also see that all garbage, waste and soiled dressings, etc., are promptly disposed of. Soiled dressings should be put in paper bags before placing in the garbage; garbage tins should always be kept covered, emptied frequently, and thoroughly cleansed and disinfected. All soiled utensils should be cleansed and disinfected immediately. Bedpans, etc., after use should be covered immediately, cleansed thoroughly, deodorized if necessary, and at all times kept scrupulously clean and odorless. The plumbing—sinks, hoppers, closets, etc.—often a source of odors or impurities, should be kept in proper order, with no leakage or stoppages, and kept clean, well flushed, and disinfected.

HEATING

Heating and *temperature* go together. Overheating causes bad ventilation; over-ventilating causes a large loss of heat.

Types of Heating (Direct and Indirect):

1. *Radiation,* heat passing from a hotter to a colder body by means of rays—example, an open fireplace.
2. *Conduction,* when heat absorbed by any object passes from particle to particle through that object, as through the walls of a stove, a silver spoon in a cup of hot liquid, or through the metal handle of a kettle, etc.; most metals are good conductors.
3. *Convection,* a process by which heat is communicated through gases and liquids as a result of their mobility. For example, air in contact with a hot stove, warmed by conduction, rises, cold air takes its place so that convection currents of warm air are formed. When different parts of air or water are warmed to an unequal degree, there is a difference in weight also so that currents are formed; the warmer particles being carried to a different position, give off some of their heat to cooler bodies or particles by radiation and conduction.

Means of Heating:

1. An open fireplace (direct radiation) which is a good ventilator and brings cheer, but is wasteful and provides an unequal heat.
2. Stoves which heat and ventilate but unequal gases and unpleasant odors are given off.
3. Hot air furnace, which constantly pumps in fresh air so is a good ventilator but the air is much too dry, and gases with unpleasant odor are given off.
4. Hot water and steam pipes which also dry the air (but less than hot air furnaces) unless provision is made for moistening the air by placing pans of water on the radiators, the water in which, when heated, is evaporated.
5. Electricity, which is clean and easily regulated, but expensive—not a ventilator.

LIGHTING

Lighting may be *natural* or *artificial,* and may be *direct* or *indirect.*

Natural Light—rays from the sun, through windows, etc.—is an extremely important factor and the hospital is built with a southern or southwestern exposure so that all the wards may be bathed in sunlight. Sunlight brings warmth and cheer; it is stimulating to the mind and body, and has great healing powers for mind and body which are now being utilized in the treatment of numerous diseases such as tuberculosis, anemia, and malnutrition, etc.

"It is the unqualified result of all my experience with the sick, that second only to their need of fresh air is their need of light; that, after a close room, what hurts them most is a dark room. And that it is not only light but direct sunlight they want."[1]

For this reason and for the benefits to be derived from the outside air—movement and variability, etc.—hospitals (and houses) are being built with sleeping porches so that every patient, without being disturbed in his bed, may be moved out of doors and kept there as long as desirable. Sunlight is also one of the greatest purifiers and germ killers. No bacteria can stand or live in the penetrating rays of the sun for more than a short time—no room can remain musty and a mind can seldom remain gloomy in the healing light of the sun. "Put the pale withering plant and human being into the sun, and, if not too far gone, each will recover health and spirit."[2] "It is a curious thing to observe how almost all patients lie with their faces turned to the light, exactly as plants always make their way towards the light."[3]

A nurse should therefore see that the ward is bathed in light, but that the shades are arranged so as to regulate the light and prevent it from shining in the eyes of the patient or from being a source of discomfort in any way. In certain cases it is necessary to almost entirely shut out the light—for instance, should the patient have sore eyes, following an operation on the eyes, or following an operation when sleep is desired and any outside stimulus—light, noise, etc.—is to be avoided; and in any condition when sleep is desired and in diseases mental or physical, when it is necessary to soothe, keep very quiet and free from stimulation.

The artificial light used may be from candles, lamps, gas or electricity. In hospitals electricity is usually used. It is clean, produces no smoke, or foul air and little heat; it gives a good light, is very convenient, and easily managed. Electricity has practically no disadvantages except in the cost and its possible misuse. A nurse should use strict economy in the use of lights, always turning them off when not required, also in reporting exposed wiring or any other disorder.

[1] Florence Nightingale. [2] Ibid. [3] Ibid.

PLUMBING

The plumbing includes the *water supply* and *sewage disposal.*

A nurse's duties regarding the water supply are to report any leaking taps which cannot be turned off; sinks or bathtubs, etc., with some obstruction to the outflow so that the water does not run away properly, and any odors from sinks, etc. The water should not be used for drinking purposes, without previously boiling, unless it is free from pathogenic germs. Impure water may cause indigestion, diarrhea, dysentery, poisoning or typhoid.

Sewage disposal may be by the water carriage system or by the dry system (burning). The water carriage system is used in hospitals and consists of closets, hoppers, sinks, etc. This system includes soil pipes, house drains, which carry the waste to the sewer, and intercepting traps, the purpose of which is to prevent foul air from the drains escaping into the dwelling. Great care must be taken to prevent the drains from becoming choked. Plumbing repairs are very costly and plumbing in disorder causes great inconvenience and discomfort. The obstruction is usually due to matter or objects which should never be thrown into closets or hoppers, etc.—cotton waste, matches, hair, paper, grease and other articles which through carelessness are thrown in. Nurses should be extremely careful themselves and should instruct both patients and maids in the proper use of the plumbing.

Report that the closet, etc., is choked if (1) the level of the pan or bowl remains the same; (2) if the plug is pulled, the contents rise and the water does not flow into the trap; (3) if there is a leakage at the joint at the foot of the basin; (4) if bubbling occurs in the pan or bowl; (5) if there is a foul odor—do not use.

CLEANLINESS

Cleanliness of floors, walls, ceilings, furnishings, and utensils, etc., is equally important with lighting and airing. There can be no true ventilation, which includes the removal of all impurities from the air of a room, as long as articles or any part of that room is dirty. It is useless to talk of ventilation, when every movement of air merely serves to scatter dust from surfaces, where it is relatively harmless, into the air to be inhaled by those in the room. Dust always harbors bacteria, and the dust in hospitals always harbors very virulent bacteria, because they have been discharged from the bodies of human beings where they have been strengthened because living under conditions most favorable to them and so have become very dangerous to man. Before the days of scientific cleaning in hospitals, almost every patient who entered contracted a sore throat, due to microörganisms, which was spoken of as "hospital sore throat." To-day this is almost unknown, but would again become universal should the constant attack on dust, dirt, and body excretion be relaxed.

Cleanliness is one of the strongest supporters of good health;

it affects both the mental and physical health and is a powerful prophylactic against disease. Dirt is offensive to the senses of sight, smell, touch, or taste, causing one to shrink from it. It symbolizes everything that is offensive to the senses and therefore to the mind. It depresses and inhibits the functions of both mind and body. Dirt means lack of comfort, decency and self-respect. Absolute cleanliness means freedom from germs or anything which will harbor germs. Modern surgery is based upon this and it is its first principle. It is the keynote in the campaign for the prevention of disease and the preservation of health. The art of cleaning, therefore, is included in, and is inseparable from the art of nursing. The more ambitious a student is in her profession—whether to become a superintendent or a leader in public health work,—the more essential is a true, practical knowledge of the art of cleaning in the most efficient, economical, time and energy saving way. Housekeeping may be mere drudgery or it may be an art and is now one of the sciences taught in some of the modern colleges. It is idle to talk of nursing and it is idle to talk of public health work which includes teaching habits of cleanliness, both of person and surroundings, and teaching not by talking but by demonstrating, without a practical knowledge of cleanliness. This knowledge, like all other knowledge, can only come by doing.

Cleanliness also trains a nurse in habits, essential to success in nursing, such as habits of thoroughness and deftness, method in planning her work, of going about quickly, quietly, and in a purposeful way, and in the care and economical use of equipment and supplies.

The **method of cleaning** will depend upon the *material to be cleaned*, the *nature of the dirt or stain*, the *nature and action of various cleansing agents*, and the *economy* necessary in the use of materials. Nurses may, themselves, be responsible, or may have to teach others, and to select the agents and method used in various housekeeping duties such as cleaning, washing out special materials, removing stains from linen, etc., so should be familiar with all these factors.

1. **Materials to be Cleansed:**

(*a*) Organic materials—the product of life:

(1) From the animal kingdom—wool and silk.

(2) From the vegetable kingdom—cotton and linen.

(*b*) Inorganic materials—found in the various utensils and equipment used.

2. The **Nature of Dirt, Dust and Stains:** Dirt and stains also consist of:

(*a*) Organic Matter:

(1) Animal—dried excretions and discharges from the body, scales of dead skin, blood, perspiration, oily

secretions, and foods such as meat, fats, milk, egg, albumen, proteins, etc.

(2) Vegetable—fruits, vegetables, oils, mildew, sugar, tea, coffee, etc.

(*b*) Inorganic Matter—acids, alkalies, medicine, minerals, sand, ink, rust, etc.

The danger of dust and dirt lies in its constant tendency to settle in dark, damp, warm, out of the way places, apt to be overlooked, and away from air currents so that it forms a lurking place for germs. It forms an excellent soil for their growth, and when carried into the air is very irritating to the mucous lining of the nose and throat, etc., and may cause infection. As previously stated, the germs harbored in a hospital are often very virulent, and the resistance of the patients in a hospital is greatly lowered.

The removal of this dirt, then, is essential because: (1) It endangers the health; (2) it has a depressing effect on the mind; (3) it is a cause of irritation to mucous membranes; (4) it may spread disease. Removal does not mean stirring up or scattering from one place to another—much better leave it alone unless it is actually removed. Dirt is removed by sweeping, washing and dusting; a nurse usually is held personally responsible for the dusting only.

The principal points to consider in dusting are: (1) To have the right attitude toward the work; (2) to dust after, not before sweeping; (3) to use clean water and a clean duster; (4) to use a damp (not wet) cloth, to which the dust particles will adhere, for all surfaces except electric fixtures and polished furniture; (5) to dust with a firm, even stroke, not round and round; (6) to dust thoroughly going well into corners, etc.; (7) to have a system in working avoiding waste of time and energy; (8) to be economical in the care and use of materials; (9) to do finished work, using a dry duster to dry or polish the surface, and arrange articles, table, chair, etc., in order.

3. The Nature and Action of Cleansing Agents:

(a) *Nature's purifiers*—moisture (dew, frost, water), air and sunlight. These stand first because they are always available, are found everywhere, cost nothing, being free to everyone, and are indispensable. As stated previously, sunlight kills bacteria, molds, and other lower forms of plant life. The oxygen in the air, because of its readiness to combine with other substances, in the presence of heat and moisture, breaks up, by oxidation, both organic and inorganic harmful substances and renders them harmless. Owing to this oxidation process, removing stains from cotton or linen by moistening with water, dew or frost, and exposing to sunlight is the simplest, cheapest, and safest method of bleaching. Sunlight, however, is not used to bleach woolens or silks, as it turns them yellow.

(b) *Solvents.*—Water is the universal solvent and it also acts mechanically by carrying the dirt away. *Cold* water dissolves albumen (whereas hot water fixes or cooks it), so should always be used for organic animal matter, which usually contains albumen. The addition of soap is necessary to dissolve fat. The soapsuds carries the fat in the form of an emulsion. *Hot* water dissolves fat but is not used to remove grease stains from fabrics, as it changes the fat to fatty acids which produce a dark stain difficult to remove. Cold water is the safest solvent to try for dirt or stains of unknown nature, as it may remove the stain and, in any case, will do no harm. *Soft water* is the best solvent but frequently contains dirt which it gathers in its passage.

A temporary hardness of water is due to a soluble lime compound (the salts are compounds of calcium or magnesium and carbonic acid), which will combine with soap and form a greasy scum unless the water is previously boiled. This causes the lime to settle out. Water with a temporary hardness, then, may be softened by boiling.

The hardness is said to be permanent when not removed by boiling. The compounds are not carbonates but sulphates of magnesium or calcium. This hardness may be removed by adding an alkali, such as sodium carbonate, borax, or ammonia, before boiling. The alkali enters into combination with the salts in solution and changes them from sulphates into insoluble carbonates which precipitate out, leaving the water soft. Soap with soft water forms a lather. It is difficult or impossible to obtain a lather with soap and hard water (a scum or flaky substance forms), so the use of soda saves the soap and is economical—1 lb. of soda to 200 gallons of water or 30 grains to 1 gallon. Care must be used in the use of the alkali, using only as much as necessary to precipitate the salts; more is very destructive to both the hands and clothing.

Fat Solvents.—Alcohol, chloroform, ether, gasoline, kerosene, or benzene are solvents of fats or grease. Oily dirt is insoluble in water. Alcohol is frequently used in cleaning glass, in removing stains and for bathing the skin, which it cools, cleanses, hardens, and refreshes. Kerosene is sometimes used for cleansing bathtubs and hoppers, etc. These solvents are all inflammable and are therefore dangerous; they also evaporate and are costly, so care must be taken to keep them away from heat, to keep the cork in the bottle and to avoid any waste in using.

(c) *Chemical agents* may also act as solvents by combining chemically with the dirt and changing it into a soluble substance easily removed. The chemicals may be acids, such as oxalic acid or hydrochloric acid; or alkalies, such as ammonia, sodium carbonate (washing soda), potassium carbonate (potash or lye derived from wood ashes and used in making soft soap), and laundry, toilet, hard or soft soap.

Soap, so extensively used to-day, was, in very early times, quite unknown. Clothes were rubbed and beaten in the running water of streams, as you will remember the sisters of the old Hotel Dieu in Paris used to wash the bedlinen in the Seine to loosen the dirt. Oily dirt required a great deal of rubbing, so much that the clothing was injured.

The Ingredients of Soap.—Soap is made by combining fat with a caustic alkali. Fat consists of fatty acids and glycerin, the fatty acid of which combines with the alkali to form a soap. Soda, which makes a hard soap, is the alkali exclusively used in the United States. The fats used may be tallow, grease, cottonseed oil, cocoanut oil and olive oil, etc. Resin is used in the yellow laundry soap—resin aids in forming a suds and carries off the dirt. If too much resin is used the soap is irritating and destructive to the hands and fabrics.

The cleansing action of soap is the result of:

1. A Physical Action combined with a Mechanical Action.—A hot, soapy solution loosens, dissolves, and removes the dirt.

2. A Chemical Action.—Soap is an emulsifying agent and the dirt in clothes is largely of an oily nature. The soap causes a dissociation or breaking up of the salts in the water (the caustic soda and fatty acid of the soap separate) setting free the alkali which combines with the fatty or oily substance on the skin or clothing, thus making more soap so that an increasing lather is formed, and the dirt is removed.

(d) *Absorbent agents*, such as white blotting paper, dry starch, meals, magnesia, and fullers' earth (a kind of clay used by fullers, workers in cloth). These are used chiefly to remove grease stains especially from fabrics injured by wetting. The grease is first dissolved by heat or one of the above solvents and the absorbent is quickly applied to both sides to cause rapid absorption, and renewed as soon as saturated.

(e) *Bleaches* are agents which remove stains by oxidation. As previously stated, sunlight with moisture is the safest bleach for cotton and linen but not for woolen or silk. Borax and ammonia are mild bleaches which may be used safely for woolens. Hydrogen peroxide, potassium permanganate, oxalic acid (in half-strength solution), and Labarraque or Javelle water are oxidizing agents commonly used as bleaches. Javelle water is made by mixing thoroughly a solution of one pound of washing soda in a quart of boiling water with a solution of one-fourth pound chloride of lime with two quarts of cold water. It is used with an equal amount of hot water, 110° F., followed by thorough rinsing in several waters.

(f) *Mechanical agents* cleanse by rubbing, friction, scouring, scrubbing or by movement—movement of the water or swishing or turning, etc., of the clothes. The agents used are bon-ami (whiting in cake form), whiting (fine pulverized chalk, freed of impurities), sapolio (sand and soap), or silicon. In selecting the agent, consider its effect on the material—does it injure it, scratch, roughen, or deface in any way?—and consider economy in use and in price.

Extraction and suction, by means of vacuum cleaners and suction tubes are used for cleansing plumbing, hoppers, basins, floors, walls, and furniture.

4. **Care of Specific Materials**—such as found in basins, bedpans, etc.:

(*a*) *Enamelware.*—Wash with warm water and soap. To remove stains use a fine abrasive soap, such as porcella or bon-ami, or use Labarraque's solution. Avoid coarse abrasives as they spoil the enamel. Strong acids and alkalies also destroy the polished surface.

(*b*) *Nickel* can be kept bright by using hot soapy water. If it becomes discolored, it can be cleansed by using whiting or a fine abrasive.

(*c*) *Porcelain.*—For daily cleaning, wash with soap and water or a fine abrasive. For removing stains, use kerosene or tincture of iodin; to remove an iodin stain use alcohol, which dissolves it.

(*d*) *Glass.*—Wash with soap and hot water. Dry with a soft cloth or a soft chamois-skin. If badly soiled or stained, use whiting; a little ammonia may be used. Too much ammonia will destroy the polished surface of glass.

(*e*) *Marble.*—Wash with soap and water or bon-ami. If badly stained a fairly strong solution of an alkali may help to remove it. Never use acids on marble or tile. If an acid is spilled, immediately neutralize it with an alkali (aqua ammoniæ or washing soda). Abrasives remove the finish.

(*f*) *Aluminum.*—Wash with hot water and soap, bon-ami, or whiting. Discoloration may be removed with a good metal polish. Never use acids and strong alkalies, and do not scrape.

(*g*) *Copper* should be washed with soda and hot water to remove the grease. Stains may be removed with vinegar and salt; rinse thoroughly.

(*h*) *Silver* should be boiled in an aluminum or tin dish in a solution of one tablespoon of sodium bicarbonate and one teaspoonful of salt to a quart of water. Silver and other small articles are, sometimes, carelessly thrown in the garbage. This should be avoided. An inventory of the silver should be kept and checked frequently.

5. **General Rules for the Removal of Stains.**—(1) Note the kind of material stained, the nature of the stain, and select the appropriate method. (2) Remove stains as soon as possible to prevent fixation in the fiber. (3) Try the simplest methods first. (4) When in doubt use cold water first—hot water will fix some stains whereas soaking in cold water will not fix stains and will often aid in their removal. (5) Soap will fix some stains, therefore always remove a stain before the article is washed. (6) When using boiling water, stretch the stained part over a bowl and pour absolutely boiling water with force (kettle held

high) through the stain until it disappears. (7) When using an acid, stretch the stained part over a bowl of boiling water, apply the acid with a medicine dropper or old toothbrush, dipping the stain occasionally into the water and again applying the acid. When the stain disappears rinse thoroughly in clear water, then in tepid water containing a little ammonia which will neutralize any acid remaining and prevent any injurious effect. (8) When bleaching by sunlight, wet the cloth or stain and lay it upon the grass in the direct sunshine. Sunlight bleaches by oxidation in the presence of moisture. Keep the stain moist and leave it on the grass as the process is slow. (9) Peroxid of hydrogen and dilute ammonia also bleach by oxidation and are particularly useful for woolens. Use equal parts of fresh peroxid of hydrogen and dilute ammonia (one teaspoonful of ammonia to one pint of water) and moisten the stain until it disappears. (10) When bleaching with Javelle water, stretch the article and rub the Javelle water into it; then rinse thoroughly and quickly in clear water and finally in water containing a little ammonia. (11) Always rinse out acids or bleaches thoroughly. (12) Bleaches, strong chemicals, are used only as a last resort because of their possible injurious effect. (13) Repeated short application of chemicals, washing after each in clear water, are less harmful to fabrics than one long application. (14) Volatile liquids such as gasoline, benzene, chloroform, or alcohol should be used in daylight, if possible in the open air, and never near a lamp or fire, as the fumes are very inflammable. Do not put any of these agents on a wet cloth as it weakens the action of the liquid, and may also leave a stain.

6. Removal of Specific Stains:

(a) *Acids.*—Sponge with water containing a few drops of ammonia.

(b) *Alkalies.*—Wash with warm water containing an acid such as vinegar, lemon juice, or cream of tartar.

(c) *Albumen.*—Wash in cold water.

(d) *Argyrol.*—Soak in 5 per cent. potassium cyanid (K.C.N.); or apply salt and ammonia to the fresh stain.

(e) *Anilin dye.*—For such stains as methylene blue (frequently used to color bichlorid of mercury), apply a bleach such as Javelle or oxalic acid or both, thoroughly washing out the bleach afterwards.

(*f*) *Blood.*—When *fresh* or recently dried, soak in cold or tepid water with or without ammonia (ammonia is a solvent of blood); then rub out; when the stain is brown and nearly gone wash out with soap and warm water. If very dry apply peroxid of hydrogen; soak and wash out. When the *stain is old,* keep it wet with peroxid of hydrogen and ammonia for several hours if necessary. For thick blood and blood on bed ticking, apply a thick paste of starch and water and allow to stand in the sun;

when the paste is dry and discolored remove it and apply a fresh paste.

(*g*) *Balsam of Peru.*—Soak in alcohol or kerosene. Wash out the grease stain of kerosene.

(*h*) *Bichlorid of mercury.*—The stain, if present, is due to the anilin dye used in coloring—see anilin dye.

(*i*) *Chocolate or Cocoa.*—Wash in cold water (first covering with borax helps); rinse and then pour boiling water through it. If unsuccessful use a bleaching agent.

(*j*) *Coffee.*—Pour on boiling water from a height. If unsuccessful use a bleaching agent.

(*k*) *Fruit.*—Apply warm alcohol to soften and dissolve the stain; then pour on boiling water from a height; or rub with salt before applying the boiling water. If unsuccessful use oxalic acid or a bleaching agent.

(*l*) *Grease, oils.*—Wash in warm water and soap. For materials injured by wetting use a grease solvent such as gasoline; chloroform or carbona may be used; they are better and there is no danger from flame or explosion. Use by daylight and in a draft. Always rub toward the center (to prevent spreading and a "grease ring") and use an absorbent such as blotting paper or several folds of clean cloth under the stain.

(*m*) *Ink.*—The method depends upon the character of the ink. The following agents and methods may be used: (1) When very fresh it may sometimes be washed out in clear water. (2) Apply dilute hydrochloric acid or oxalic acid (one-quarter teaspoonful to a cup of water); rinse thoroughly. A few drops of Javelle water may be added to the first acid used, followed quickly by boiling water. (3) Moisten with salt and lemon juice and lay in the sun; wash with soap and water. (4) Moisten stain and apply salts of lemon in powder form; then pour on boiling water; rinse with soap suds. (5) Apply peroxide of hydrogen and dilute ammonia. (6) *Red ink* may be removed with cold water or water and ammonia, or with Javelle water. (7) For *indelible ink,* if the base is silver nitrate, apply a 10 per cent. solution of potassium cyanid; if an anilin dye, treat as anilin dye.

(*n*) *Iodin.*—Apply ammonia or chloroform and wash in warm soapy water. Wash with alcohol. Apply a starch paste renewing until the stain is removed.

(*o*) *Medicine.*—These stains may frequently be removed with cold water or by soaking in alcohol.

(*p*) *Mildew.*—If fresh, it may be removed, but when old, it cannot be removed. Moisten with a strong soap solution; apply a paste of soap or salt and chalk and leave in the strong sunlight for several hours; if unsuccessful use Javelle water or other bleaching agent.

(*q*) *Milk or Cream.*—Wash first with cold water; then soap and tepid water.

(*r*) *Mucus.*—Soak in salt and water (two tablespoonfuls of salt to one quart of water); or wash in ammonia and water before washing in soap and water.

(*s*) *Perspiration.*—Use a strong soap solution and let the article lie in the sun; or wash in water containing a few drops of ammonia, or use a strong bleaching agent.

(*t*) *Picric Acid.*—Soak for one minute in a solution of potassium sulphate; then wash with soap and water or apply a paste of magnesium carbonate for an hour or so.

(*u*) *Rust.*—Lemon juice, salt and sunlight may dissolve it, or dilute hydrochloric acid (this changes the rust to a soluble chlorid), oxalic acid and dilute muriatic acid may be used.

(*v*) *Silver Nitrate.*—Apply ammonia, or a 10 per cent. solution of potassium cyanid, or bichlorid of mercury to the stain, then wash.

(*w*) *Tea.*—Rub out in cold water; then pour on boiling water. Glycerin may be used first to soak the stain.

(*x*) *Urine.*—Wash with warm water and soap, or sponge with alcohol or dilute citric acid.

(*y*) *Vaselin.*—Soak in kerosene before washing—the kerosene evaporates; or wash with turpentine.

Hospital Pests

Hospital pests, insects or animals—flies, roaches, bedbugs, mosquitoes, moths, pediculi, fleas, rats and mice are, as the word "pests" suggests, a great nuisance and menace, and are often destructive to the hospital. To the patients they are a source of annoyance, discomfort and alarm, disturbing their rest and sleep, and also a source of danger as they spread disease. They are lovers of filth; they suggest filth and are disgusting and in some cases nauseating especially to a sick patient. It requires the utmost vigilance on the part of everyone to keep the hospital free of them.

Flies breed in putrefying and fermenting organic matter. They are attracted by food, garbage and excreta, etc. They multiply very rapidly in warm weather, depositing about 150 eggs at one time.

They are *offensive* and *dangerous* because their bite is very irritating, very annoying, and a source of great discomfort; they disturb the patient's rest and sleep; they are disgusting to see on food, suggesting filth; they are dangerous because they carry infection on their feet, spreading anthrax, typhoid, cholera, dysentery, infantile diarrhea, gangrene, etc.

To get rid of them remove all breeding places; leave no food or dirty dishes, etc., where flies can reach; keep garbage tins covered; keep screens on doors and windows and use electric fans; see that there is nothing to attract them; see that the ward, the utensils and patients, especially infants and children, are kept spotlessly clean; place traps and fly paper in places likely to attract, such as on the top of garbage tins or near the light; use the fly swatter vigorously; keep netting over a patient with an infectious disease both for the comfort of the patient, and to prevent the spread of the disease; darken the room as they tend to follow the light.

Roaches are found wherever there is food and moisture—in the kitchens and around the water pipes, etc., and they are apt to get on the trays either when set or if not kept clean. They are more abundant and active at night.

They are *harmful* because they carry filth on their bodies and feet and may carry infection; they are alarming, when on the tray or dishes, to nervous, helpless patients with a dislike of crawling things; they get into the food and are disgusting and nauseating; they destroy the appetite and set up disagreeable associations with that food.

To get rid of them have everything absolutely clean; have no food to attract; starve them out; use borax powder, kerosene, sulphur fumes or exterminator; keep plumbing and building sanitary.

Bedbugs are not always associated with filth, but are found sometimes in new lumber; they are found in cracks, walls, picture moldings, woodwork and beds, etc. They come out at night.

They are *harmful* because their bite is very irritating and poisonous to some people, and may carry certain kinds of diseases; they disturb the patient's rest and make sleep impossible; they make the patient nervous and restless; they are alarming to some, and have a nauseating odor, and may carry dirt and disease.

To *prevent bedbugs* a building should be insect-proof and made of good lumber. In a hospital there are no moldings, pictures, wallpaper or wooden beds, etc., and this helps to keep it free from such pests. Constant vigilance, however, is necessary as both patients and visitors frequently carry them into the wards. The beds should be inspected frequently, kept clean and kerosene or gasoline should be used frequently on the springs and mattresses. The bugs may be destroyed by pouring boiling water or carbolic over them, or by exposure to sulphur fumes, using two to four pounds to 1,000 cubic feet. For fumigation, to prepare the room, seal all crevices of doors and windows, cover or remove metal articles (the fumes are very injurious to silver), open the drawers and expose all objects. Place the sulphur powder in a flat iron pot, put the pot on bricks in a large basin or tub of water, moisten the sulphur with alcohol and light. Leave for ten or twelve hours; then open the room and air it.

Mosquitoes are found in swamps, wells, pools, barrels, gutters, empty cans, damp places, and wherever there is stagnant water necessary for breeding. They fly mostly at night and enter through windows and doors.

They are harmful because their bite is painful, very irritating, and poisonous, and they are carriers of disease. Infection may occur from scratching the bite. There are about 400 varieties—

the *Anopheles* spreads malaria, the *stegomyia calopus* spreads yellow fever.

To *suppress mosquitoes* remove all breeding places. Do not leave anything about containing stagnant water; pour kerosene on pools of water—it floats on the surface and prevents their breeding; stock the ponds with fish which eat the mosquito eggs; put screens on the windows; use electric fans; put netting over patients with malaria or yellow fever; apply spirits of camphor or citronella to the exposed skin.

Fleas are found in sandy, warm places, on domestic animals, in carpets and other woolens.

They are *harmful* because they bite, and cause discomfort, and spread disease. Bubonic plague is spread by fleas.

To destroy them observe absolute cleanliness; use tincture of green soap or naphtha soap or sulphur fumes. Keep animals out of the hospital and away from sick people.

Moths are found in blankets and other woolen goods, and in soiled or dusty garments most frequently. They are prevalent in the spring.

They are *harmful* because they destroy blankets, clothes, furs, etc.

To *prevent moths* keep garments clean, well aired, free from dust, and properly put away with camphor, moth balls, pepper, or wrapped in newspapers (moths dislike the ink) or in tin boxes or moth bags. Examine blankets and clothing carefully before putting them away.

Rats and Mice are among the worst known pests and cause great financial losses. They are found in every climate, on ships, on the wharf or docks, and in institutions, or any place where there is food. They are great travelers.

They are *harmful* because they destroy food—grain, meat, groceries, and young chickens, etc. They also destroy other materials such as carpets, and undermine the floors and walls of buildings. They may also cause fire by carrying and gnawing matches. They carry dirt and disease. Rats are said to be more or less responsible for cases of human plague and are the most frequent medium by which plague is carried from one locality to another. Rats and mice cannot be exterminated but they can be suppressed. All buildings should be ratproof; no food should be left about; everything should be kept clean with nothing to attract; they may be destroyed by traps, poison, shooting or fumigation, or by their natural enemies, dogs and cats.

Pediculi are common hospital pests. As they are usually brought in on the head or body of patients, they will be discussed in the chapter dealing with the admission of patients.

THE WARD KITCHEN

All the food and supplies, etc., are kept and served from the ward kitchen, which, in turn, receives from the main kitchen and storeroom of the hospital, according to the requisitions sent from the ward. The food and service from the kitchen are extremely important factors for the health and satisfaction of the patient, and the reputation of the hospital depends to a large extent upon it. It is one of the chief items of expense in the hospital, and may be one of the greatest sources of discontent, and of waste in ordering, and in the care, preparation and serving of the food, and also in breakages. It requires very efficient management.

Nurses are responsible for the ordering and economy in the use of supplies, for seeing that the steam table is hot, ready to receive and keep hot the food from the main kitchen, and for leaving the kitchen and utensils in order after use. They are also responsible for the care of the refrigerator and for the care of the patients' food sent in for their own use. Nurses should be economical in the use of supplies, in the care of the food, and in the serving. They should serve a satisfying amount, but not more than the patient will desire. They should be careful in the disposal of food left on the trays, in the disposal of food not served, in the use of gas, and in the preparation of food, so that neither food nor utensils may be burned. All breakages, and repairs needed, should be reported.

Care of Refuse.—There should be a proper receptacle of galvanized iron, light, watertight, easily cleaned, readily handled, and with a well-fitting cover. There should be frequent, regular collections with cleaning, airing and sunning. The receptacle may be lined with paper to keep clean, or the refuse may be wrapped in paper. The can should never be overflowing. The cover should always be in place.

Care of the Refrigerator.—It must be thoroughly clean at all times. One must be careful not to spill milk or daub butter, etc., and if done to wipe it up immediately. There must always be a sufficient amount of ice, and the doors must be kept closed to maintain the low temperature and to avoid wasting the ice. Avoid overcrowding. Keep things in their proper place—food away from milk, etc. Take particular care of the patients' food—carelessness in labeling, in putting away, in not seeing that the patient receives all that his condition allows, is often a source of great unhappiness and dissatisfaction to the patient. The drain pipe under the refrigerator also should receive careful attention to be sure that there is good drainage and that it is kept clean.

Relation of the Ward to the Linen Room and Laundry

The laundry is one of the most important, most essential, and most expensive parts of the hospital. Clean, fresh linen is essential to the health and comfort of the patients, but a patient can be well cared for, kept clean and comfortable without wasting linen. All linen and blankets, etc., are a very heavy expense to a hospital so that a nurse should be very economical in their use. She should be careful in handling and never use torn linen, but should send it immediately for repair. This saves time and expense. A nurse to-day is not responsible for washing the linen, but is responsible for its use, wear and tear, and for its condition when sent to the laundry. Damp linen should be dried before sending to the laundry, because if allowed to remain damp for some time, it will mildew. Stains should be removed at once. They can be removed easily at first, but become fixed on standing or when put through the laundry. Linen which has been used for a patient suffering from an infectious disease should be kept in a separate bag and disinfected in order to avoid spreading the disease. Care should be taken also to avoid throwing various articles, such as pillows, instruments, or rubber goods, etc., into the hamper with the soiled clothes. They may be lost or injured and they destroy the machinery, and waste time and materials.

Supply to the Wards.—Linen may come direct from the laundry to the wards, or it may all go to the central linen room, from where it is sent to the wards, in response to a requisition, to fill the day's needs. In the wards it is piled on shelves neatly and in order.

Care and Use of Linen, etc.—Bedlinen should be changed frequently enough to be fresh, clean and sweet, but no extravagant use should be allowed. Where possible, and except in the case of emergencies, there should be definite rules controlling the changing of the bedlinen. Linen may be turned and brushed or shaken; this saves wear and tear. Blankets and linen should never be allowed to drag on the floor. Blankets and spread should be protected from the face and hands by the upper sheet to protect and save washing. Sheets or spreads should be protected by a towel, and in some cases a rubber, in cases of vomiting or hemorrhage; a towel is small and easily changed and washed. The under sheet should be protected by a rubber sheet. Pillows should be protected by a rubber case in bleeding, vomiting or profuse perspiration. Linen and blankets should be protected when in danger of soiling in treatments or giving medications. Blankets are expensive and washing is injurious to them. They should be aired, brushed well, shaken and protected. Small spots should be washed out immediately. The nature of stains and methods of removing have been discussed.

Effect of Hygienic Housekeeping on the Nurse, the Hospital, and the Community.—It may readily be seen that, in addition to the health of the patient, the health of the nurse and others, the favorable impression created on visitors and on the community, the reputation of the school and hospital, the care and upkeep of the hospital and economic expenditure of funds, and the education of the student in the basic principles and methods of healthful living are all equally dependent upon hygienic housekeeping.

CHAPTER IV

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY HYGIENIC HOUSEKEEPING (Continued)

The Bed For the Sick

A bed suitable for the care of the sick, and the method of equipping and making it, whether in the home or hospital, differ in certain important respects from that used for the well, because the needs of the sick are different. The sick person not only rests and sleeps in it but may have his meals, recreation, occupation, and exercise in it, and in it all the bodily functions must be attended to. The usual demands for comfort, cleanliness, economy of materials, security, durability, and adjustability are all of added importance. It should be adapted also to the needs of those who care for the sick in order that their time and energy may be best utilized and conserved. A finished appearance and harmony with its surroundings are also important. For the bed is, perhaps, the most important and essential piece of furniture in the ward. It is the most noticeable to one entering the ward and is the one which, perhaps, concerns the patient most, and upon which his comfort largely depends, as he spends most of his time in it. It also perhaps concerns the nurse most, as the greatest part of her work is around, about, and with the bed. Its appearance can make or mar the whole appearance of the ward. The manner in which it is made can make or mar the patient's comfort, and therefore hasten or delay his recovery.

The standard hospital bed is a single bed, six feet and six inches long, three feet wide, and twenty-six inches from the floor, made of steel or enameled iron tubing which does not harbor bedbugs. It is simple, free from decoration, knobs or angles, light, easily moved, convenient to handle, easily cleansed and disinfected, and possesses strength and durability. The height and size while not always comfortable to the patient are convenient to the nurse and doctor in the care of the patient. The *castors* are made of hard rubber or hard rubber tire, and are an important factor in moving the bed without jarring the patient. The *springs* are usually the national or woven wire which are the most durable and sanitary. Adjustable beds, such as the Gatch beds, are now commonly used.

Mattresses in hospitals are usually made of stout, blue and white linen ticking (cotton ticking is not so cool or durable), stuffed with horsehair. Curled hair is the best as it gives greater resistance and can be washed and sterilized if necessary. The weight is about thirty pounds. Hair is more expensive, but wears better and is cheaper in the end than other mattresses. Ostermoor felt and silk floss mattresses are not satisfactory for hospital use because expensive and hard to clean. Horsehair mattresses are firm, cool, more cleanly, hygienic, lighter and more practical, and do not soil so readily—horsehair is non-absorbent. Mattresses must be even and smooth, without lumps or hollows, and must be firm, not loose or sagging, but giving a sense of support. Soft mattresses do not give the proper support.

The pillows.—There are usually two for each bed—one hard pillow stuffed with hair and one soft pillow stuffed with feathers (two and a half to three pounds). The hard pillow is used under the feather pillow for support to the head and shoulders and sometimes without the feather pillow for coolness in cases of fever or profuse perspiration, etc. It is also used for various other purposes such as to support a limb or to retain it in a fixed position. Smaller pillows are also used for special support or comfort.

A rubber sheet is used to protect the lower sheet and mattress. It may be cloth faced or double faced. It is narrower than the draw sheet, but is long enough to tuck in well at either side. It must be without thin places or wrinkles.

The *linen* consists of two large sheets, a draw sheet, a spread and two pillow cases. The large sheets should be strong enough to stand pulling tightly and large enough to tuck in well under the mattress all around so that they may be made smooth and tight. The *draw sheet,* which may be made of single or double cotton, must be wide enough and stout enough to pull tightly and tuck in well under the mattress. It is called a draw sheet because it is easily withdrawn and may be partly withdrawn so as to give the patient a cool place to lie on. The *spread* should be light and easily laundered—dimity washes and wears well. The *pillow slips* should fit the pillows loosely.

The *blankets* should be light and warm. They are lighter in proportion to the warmth, depending upon the amount of wool present—a blanket with sixty to eighty per cent. of wool is usually used because a blanket with a cotton foundation is durable and shrinks less in washing. The usual weight is from four and one-half to seven pounds per pair. As previously mentioned, the most scrupulous care must be taken of blankets as the most careful washing shrinks and spoils their appearance and makes them harsh and uneven. Stains should be sponged off at once—first with cold water, then with ivory soap and tepid water, rinsed partially, dried with a clean cloth, then placed in the air and sun. Use old blankets for treatments or when likely to be soiled, or when used next the patient. Never drag blankets on the floor. In hot weather all blankets are inspected and either put away carefully with moth balls, or sent to the cleaners to be cleaned, or, if badly soiled, to the laundry. Some modern laundries now clean blankets by steam, a method which is said not to shrink but to keep them soft and fluffy.

Nurses might be more careful if they realized the high cost of equipment.

The cost of equipment for one bed was in 1918 as follows:—One bedstead $10.00; a mattress cover $1.00; two pillows $4.00; eight sheets $12.00; six pillow slips $2.00; four blankets $12.00; two spreads $3.00; four nightgowns $4.00; twelve towels $2.00; a rubber sheet $2.00; one bedside table $8.00; two chairs $10.00; a share of the utensils $20.00, making a total of $100.00.[1] The cost of equipment has greatly increased since 1918.

THE ART OF MAKING THE BED FOR A PATIENT

The technique used in different hospitals varies, but the principles are the same in all. They are as follows:—(1) Have everything necessary on hand before beginning. (2) Remember that the bed is made for use, durability, and comfort and that it should have a finished appearance. (3) Place all linen perfectly straight on the bed, otherwise it will be impossible to make the bed tight and free from wrinkles. The head should be well covered. (4) See that the linen is well tucked in, far enough under the mattress to remain fixed, tight, and free from wrinkles. Tuck in on one side first, tighten on the opposite side. Tighten each article separately. (5) The rubber draw sheet must be smooth and well tucked in, and should extend from the shoulders to below the knees. (6) In tightening, do not alter the shape of the mattress, causing it to sag in the middle, and do not pull on the corners as this makes them soft, and out of shape, so that it is impossible to make good firm corners. Pull first on the center, then the foot, then the head. (7) Place the cotton draw sheet well up under the shoulders and down to or below the knees to protect the bed, otherwise every movement will loosen and wrinkle it. The weight of the shoulders holds it in place. The weight of the hips also holds it in place. See that it is well tucked in under the mattress. (8) The upper clothing should be tucked in neatly and well, but not too tightly for comfort. Allow sufficient room for turning and for the comfort of the feet; they must not be in a cramped, awkward position, which not only makes them uncomfortable but also makes them numb and cold. (9) The upper sheet (wrong side up) should be tucked in well at the bottom, but left free at the top with enough to turn over the spread and blanket, to thoroughly protect them. (10) Blankets should be far enough up to protect the shoulders well. (11) All the corners should look neat, smooth, and firm. (12) The pillows should be snugly tucked into the corners of the case and should be neat, flat, and smooth. Untidy pillows will spoil the appearance of the bed. (13) Throughout the procedure a nurse should study her movements so as to avoid waste of time and energy. (14) When finished inspect the bed to see whether it measures up to the highest standards. These are the health and comfort of the patient, economy of time, effort, and materials, and a smooth, finished appearance. Then straighten the bed, table and chair. The most finished bed may be spoiled by untidy surroundings.

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[1] American Journal of Nursing, 1918.

When stripping a bed to remake it, place the chairs in position for the bedclothing; remove the pillows; loosen the clothing all around, and remove one article at a time; spread the clothes to air, but do not let them touch the floor; turn the mattress from top to bottom; strip the bed as soon as the patient is up; open the windows and allow the bed and linen to air, if possible, for one half to one hour.

The Care of Beds and Bedding

In addition to the daily dusting of the beds and care of bedding, after the discharge of the patient, a more thorough cleansing is given than is possible when the patient is in bed. Where possible, it is advisable to move the bed, mattress, pillows and blankets to a balcony where they may be exposed to the sun and air, and plenty of water used without danger of splattering the floor. Otherwise, where necessary, the floor should be protected.

The *bed* should be thoroughly cleansed with warm water and soap. All stains should be removed. Bon-ami may be used if necessary. *Mattresses* and pillows should be well aired and thoroughly brushed with a whisk moistened in water or a disinfectant solution. Special attention should be given to tufts and binding. Examine carefully for bedbugs. Also, examine for tears and send for repair if necessary. All stains should be removed. Care should be taken to air all sides, but to avoid bending the mattress or pillows at a sharp angle as this is injurious to them. Care should also be taken to avoid placing them on a dirty surface, and to protect them from dust or soot, etc. *Rubber draw sheets* should be thoroughly scrubbed with warm water and soap and thoroughly dried. When not in use they should be rolled on wooden rollers; folding them cracks the rubber and makes it useless. Rubber pillow cases are treated in the same way.

After the discharge of a patient suffering from an infectious disease, mattress and pillows, etc., should be disinfected. Mattress and pillows may be exposed to hot air, steam under pressure, or fumes of formaldehyde. Blankets are usually disinfected by exposure to fumes of formaldehyde. Rubber sheets may be exposed to formaldehyde fumes or immersed in a two per cent. formalin solution.

CHAPTER V

OBSERVATION IN THE PREVENTION AND CURE OF DISEASE

The Habit of Observation Essential in Nursing.—Observation is the beginning of wisdom. Observation is used here in its broadest sense to mean, not just the impressions made on the retina of the eye, but to mean all that is noted or registered on that inner eye, the mind, through the various senses—the nerves of the eye, ear, nose, mouth, skin, and muscles—the channels by means of which messages or stimuli reach the brain. It means that deeper insight, that inner perception, finer than sense, which carries with it a feeling, an understanding, and a desire, born of that understanding, to react or to do something about that which is observed.

Observation the Responsibility of the Nurse.—This habit of observation, for it should become a habit, is one of the most, if not the most, essential factors in nursing. "For it may safely be said, not that the habit of ready and correct observation will by itself make us useful nurses, but that without it we shall be useless with all our devotion." Without it we cannot practice the first essentials in nursing—"the proper use of fresh air, light, warmth, cleanliness, quiet," or comfort, rest, and sleep, "and the proper selection and administration of diet."

There are three aspects, of primary importance, in which the habit of keen, accurate observation—a sensitiveness to and insight into all that relates to the patient, social, mental, and physical—may be considered essential to the student in nursing:

1. The responsibility of the nurse (student or graduate) directly to the patient; and indirectly, through her responsibility to the doctor whose co-worker and assistant she is.

2. Responsibility to the family and community.

3. The responsibility of the student to herself for her own development and success in learning; and to her profession for the development of the spirit, the knowledge, and the art of nursing.

1. *Responsibility to the Patient.*—The habit of observing and reporting symptoms is distinctly the responsibility of the nurse; for, during the greater part of the time, she is the only one there to care for the patient, to observe and to report; and "what is the nurse there for except to take note of these things?" Without close observation, as stated above, a nurse cannot carry out the first essentials in nursing—those measures prescribed, not

by the doctor, but dictated by the underlying principles and methods of nursing itself. (See page 4.)

Symptoms observed and reported at the time, as, for instance, in regard to the expectoration of sputum, are often of much greater importance than laboratory tests. By accurately reporting symptoms at the time a nurse greatly aids the doctor in making a correct diagnosis and in prescribing the proper treatment; and frequently is the means of saving the patient's life. This is particularly true in the care of infants and children, delirious, unconscious, or very ill patients. And very important, also, and all too frequently neglected, is the careful observation and intelligent care of the convalescent whose reviving interests and strength demand some form of expression in the form of mental or physical activity.

2. *Responsibility to the Family and Community.*—The prevention as well as the cure of disease is the object of nursing. The nurse is concerned not only with the patient who has succumbed to disease, but is responsible for observing in those with whom she comes in contact even minor mental or physical defects and symptoms which indicate subnormal health or predispose to later mental or physical disease. "An ounce of prevention is worth a pound of cure" and many a tragedy might be avoided by early recognition, by health teaching, by correcting faulty habits, and by proper medical or surgical treatment.

3. *Responsibility to Herself and to Her Profession.*—To learn by the *observation of facts*, prompted by interest and a desire to know; to learn by *recalling facts observed* in our past experience; to learn by *comparing and thinking* about them; and by *observing the relationships* between them to gain an insight into the problem and its solution, is the typically human method of learning which distinguishes it from the mere trial and error method of animals.

We cannot profit or learn by our past experience except by observation, for we can only remember clearly, accurately, and with certainty facts which we have definitely observed when before us; we cannot learn by thinking, except by observation, since in thought we must use facts which we have previously observed and recall—we can observe and learn new facts by comparing facts recalled, but what is there can only be observed when it is there. It is this fact which makes the observations of the nurse so important for the doctor who is not there. We cannot develop any art, or become, to the highest extent, efficient and skilled in manual work except by observation; for repetition is not enough—observation and measurement are necessary to avoid waste of time and energy, and to make practice intelligent and fruitful.

This power of observing facts, of recalling, comparing, thinking, and thus learning new facts and skills, is something which a student must acquire for herself. Our teachers can help us by supplying facts and underlying principles, and by stimulating our interest and directing our attention; but it is the student, herself, who must be interested, must pay attention, must observe, record, think, reason, and learn for herself. This close observation of facts, the relationship of cause and effect, the application of a scientific method of work, and the accumulation of organized knowledge based on this method, lift nursing far above a mechanical, routine, unintelligent practice, and mere trial and error method of learning; and place it upon a sound, scientific and professional basis.

Essentials in Observation.—Observation depends upon: (1) Sympathy, insight and a desire to be of real service to the patient; (2) Interest and a desire to know all that relates to his welfare; (3) Knowledge of the disease—its cause, pathology, symptoms, course, treatment, dangers, complications, prognosis—all of which tell us what to observe, how to observe, and what is of importance; (4) Knowledge of the patient, himself,—his family, social, and medical history, his mental and physical health habits; (5) A scientific attitude and method of work; (6) Experience, trained senses, a mind trained to think, and the necessary characteristics of patience, accuracy, open-mindedness, truthfulness, persistence, and industry.

All these essentials can only be gained by constant practice; for, while the habit of observation can be developed, it can only be formed by constant practice in doing. "Stop! Look! Listen!" is a good motto for student nurses. Each time this habit of looking, listening, feeling, or thinking is repeated it is strengthened until the habit of observation is firmly established; once formed, the habit will never fail us. Beginning with the first day in the ward a student nurse should consciously set about cultivating this essential habit.

Method of Observation.—The practical lesson which every student must learn is: "What to observe—how to observe—what symptoms indicate improvement—what the reverse—which are of importance—which are of none—which are the evidence of neglect—and of what kind of neglect."

WHAT TO OBSERVE

1. Symptoms which relate to the Nursing Care and Treatments.—The nursing care of patients has a distinct therapeutic value quite apart from the treatments prescribed by the doctor. This is true in all cases and in some diseases the life of the patient depends almost entirely upon the nursing treatment and care. In the care of such diseases as pneumonia and typhoid fever, an eminent physician has said: "That a good nurse without any doctor is better than the best doctor without any nurse." The effect of such care should, therefore, be studied and observed in a scientific manner with its true value in mind. This will include the safety, happiness and comfort of the patient, his rest and sleep, diet and nutrition, eliminations, exercise, recreation and occupation, and the therapeutic effect of all treatments performed by the nurse.

Many years ago the long and wide experience of Florence Nightingale taught her, "that the symptoms or the sufferings generally considered to be inevitable and incident to the disease are very often not symptoms of the disease at all, but of something quite different"; and that, "if a patient is cold, if a patient is feverish, if a patient is faint, if he is sick after taking food, it is generally the fault not of the disease but of the nursing." Such symptoms, if they exist, are a guide to the nurse and should receive her immediate attention. If they are neglected, although due to poor nursing, and are reported they may be very misleading and obscure the diagnosis and treatment; for the physician takes it for granted and has a right to expect that the patient is receiving the best nursing care. The whole purpose of the observation and reporting of symptoms is, not to hinder, but to aid in the correct diagnosis and treatment to the end that the patient may be cured.

2. **Symptoms which relate to the Disease.**—The onset and diagnosis, course and progress, symptoms of danger or of complications.

3. **Symptoms which relate to the Results of Medical Treatments.**

4. **The Student's Achievement and Progress.**—Each student, as well as the teacher, should observe and measure her own progress in the power of observation, in technical skill, in knowledge, in acquiring desirable personal qualities and attitudes, and in measuring up to the standards of work given.

Symptoms and Signs.—Symptoms may be *subjective*—those felt or experienced by the patient himself, of which he may or may not voluntarily complain—such as pain, itching, tenderness; or they may be *objective*—those which may be noted by an observer—such as pallor, swellings, distention, and rashes. The term *physical signs* is commonly reserved for those objective symptoms revealed by special methods of examination, such as percussion, palpation, auscultation, and manipulation. The cardinal symptoms—temperature, pulse, blood-pressure, and respiration, discussed elsewhere because of their special and general significance—are thus physical signs.

Symptoms to Note in the Daily Care of Patients:

1. Those relevant facts which relate to his *Family and Social Life*—family affection and support, or neglect, and responsibilities which cause worry and anxiety; *social relationships*—friends from church, lodge, shop, neighborhood, or social agency; *standards of living* as expressed in locality of home, occupation, education and culture, dress, manner, health habits, and general appearance.

2. His *Mental Life, Temperament, Psychical Condition*—interests, use of leisure, reaction to people and surroundings;

mental characteristics—nervous, irritable, sensitive, phlegmatic, emotional, easily elated or depressed; *psychical condition*—as expressed in facial expression, dress, behavior, mannerisms, ideas, memory, judgment, ability to respond; *mental activity*—apathy, depression, sluggishness, dullness, confusion of mind, melancholy, talkativeness, excitement, exaltation, consciousness or unconsciousness.

3. His *Physical Condition: Head and Face*—position, size, shape, color (pale, cyanotic, jaundiced, or flushed); swellings, movements of the head, spasms, or paralysis of muscles; *facial expression*—often very significant and indicative of serious mental or physical disturbances; it may be dull, apathetic, indifferent; anxious and distressed with pain; pinched, anxious, and worried as in pneumonia, hemorrhage, or obstruction; it may show fear of a treatment or operation, or fright and alarm as in a large hemorrhage; it may show fatigue, content or dissatisfaction with the nursing care; it may show marked emotional disturbance, or be vacant and devoid of expression as in a serious brain lesion.

The *eyes*—their expression, vision, sensitiveness to light (photophobia): movements of the eyeballs, and whether sunken or protruding: the *lids*—red, swollen, heavy, or drooping; spasms or closure of the lids: the *pupils*—dilated, contracted, or unequal, and their response to light and accommodation: the color of the conjunctiva and sclera: *secretions* and *discharges*—their character and quantity: puffiness or dark circles under the eyes.

The *nose*—shape, sense of smell, difficulty in breathing, or discharge.

The *ears*—their shape, color, hearing, the presence of tinnitus, pain or tenderness behind the ears, discharge of blood or pus.

The *mouth*—Note the *lips*, whether pale, blue, or healthy in color, dry and cracked, the presence of herpes, sordes, or ulcers, and whether open, trembling or twitching. Note the *breath* which may be hot and feverish, heavy, sour, foul or fetid from decayed, ulcerated teeth, from chronic catarrh, from diseased tonsils, from the stomach or intestines, or from abscess or gangrene of the lungs. Sometimes the odor of alcohol or of certain drugs such as opium, or an odor characteristic of certain diseases, such as diphtheria, or a sweetish odor in diabetes, or of urine in nephritis, may be detected. Note the *teeth*—their number, shape, whether in good condition, or loose, decayed, true or false, and the presence of bridge work and fillings. Note the *gums*—whether pale or normal in color, spongy, bleeding, receding, and any unusual marking such as a grayish, or a greenish blue line along the margin. Note the *tongue*—whether moist, clean and normal in color, or dry, pale, furred, brownish, or grayish: note whether coated all over, or in the center with the margins bright red, and the presence of patches, fissures, ulcers, scars, or marks of teeth: note its size and mobility—whether enlarged or atrophied, and the presence of swellings or tumors, or of spasms, tremors, or paralysis. Note the *sense of taste*—whether normal, perverted or lost, and the *appetite and thirst*—whether increased or blunted, lacking or craving, with special likes or dislikes, and a "longing for" or a "turning against" certain foods.

The *throat*—the presence of redness, swelling, patches, ulceration, or discharge; hoarseness, difficulty in speaking or in swallowing, or external swelling, enlargement, or tenderness to the touch.

The *condition of the body:* the *posture,* whether erect, steady and firm on the feet; *height and weight*—whether poorly or well nourished, emaciated or fat, with evidence of gain or loss in weight; bones prominent or well padded, muscles firm or flabby, the skin loose, wrinkled, and in folds, or smooth, firm, tense and close-fitting.

The *position of the patient*—Note whether he lies on his *back* comfortably, without constraint, or from weakness slips down in bed with resulting discomfort and difficulty in breathing; or lies rigidly with one or both legs drawn up to relieve abdominal pain. Note whether he lies *on one side,* in a comfortable position, or rigid with pain, afraid to move; or on the *affected side,* as in pleurisy, in order to relieve pain and aid breathing by pressure, or on the *unaffected side,* as in sciatica, to avoid pain. Note whether he lies *prone* for comfort or to relieve pain, as in colic and certain spinal diseases, or whether he must *sit up in bed* (orthopnea) because impossible to breathe when lying down.

The *movements of the body*—the patient quiet and at ease, or restless, tossing, turning from side to side, as in hemorrhage (air hunger), or in severe pain, as in colic; difficulty in turning, or irregular muscular movements, twitching, spasms, tremors, or convulsions.

The *condition of the abdomen*—whether soft, relaxed, or distended by gas or fluid, or enlarged by tumor; tender to touch or pressure, or rigid with pain. Note the movements in breathing.

The *condition of the chest*—its size, shape, movements, and the presence of coughing, or expectoration.

The *extremities:* Note particularly the *hands,* for the hand is often a more accurate index of the patient's condition than the face. Note whether emaciated or fat, the skin loose or smooth and stretched with edema, and whether hot or cold, moist or dry, pale, flushed, or cyanotic. Note the *fingers*—whether long, tapering or "clubbed" as in certain forms of heart disease. Note the *nails*—whether pale, cyanotic, or normal in color, dry, hard or brittle, and the presence of redness, tenderness, or discolorations, and the general care. Note the *movements of the hands,* whether restless, trembling, picking at the clothes, or listless and inactive. Note the *legs and feet*—their position and movements, the gait, difficulty in walking, shuffling or dragging of the feet, loss of motion. Note the *joints*—whether enlarged, swollen, tender, or distorted; the *circulation*—the presence of edema, discoloration, varicose veins, heat, moisture, and sensation. Note any swelling of the *glands* of the groin, neck, axilla, breast, and the presence of any growths, or abnormally tender spots.

The *condition of the skin*—the presence of itching, scratches, abrasions, sores, ulcers, wounds, scars, rashes, edema, tenseness or cracklings: the *temperature and moisture*—whether warm, dry, hot and feverish, or sensitive to cold, shivering, cold and clammy. Note whether heat or cold is local or general, and whether sweating is local, general, profuse or absent; note any abnormal odor of the perspiration such as the odor of urine. Note any abnormal *color* such as a grayish, yellowish, or bluish tinge, jaundice, cyanosis, pallor, or redness: note whether pallor is transient, lasting, sudden or progressive; and whether redness is diffuse or localized, as on one cheek in pneumonia. Note whether the skin is thin, red, tender and apt to become sore, particularly over the buttocks, prominent bones, and between folds.

Note the *body excretions,* any vaginal discharge, and any lack of control of the rectum or bladder.

Note the *loss of function* of any of the special senses.

Note the *general condition*—whether the patient is gaining or losing in strength; whether he is more or less tired by exertion; whether he feels like doing things for himself, or whether he is too weak and listless to make the effort. Note whether he is eating well or not, whether his appetite is improving or not, and whether he expresses any desire for food or other things which formerly gave pleasure. Note whether he enjoys visitors, conversation, or reading, or whether he is easily tired. Note whether he is sleeping well or not, and note the character, time, and duration of the sleep. Any *change* indicating either improvement or the reverse should be noted and reported.

Subjective symptoms, as previously explained are sensations, feelings or emotions expressed by the patient. They are sometimes spoken of as "the complaints" of the patient, although the sensations or feelings may be pleasant and happy, and indicate the absence of complaints; negative symptoms are often quite as important as positive symptoms.

The more common symptoms are: (1) *Pain or tenderness;* (2) *Sensations,* such as itching, tingling, prickling, burning, numbness, throbbing; heat or cold, shivering, hot or cold flashes; sensitiveness to light, darkness, noise, color, odors, touch, pressure, heat, cold, draughts; hunger, thirst, loss of appetite—"nothing tastes good"—a sense of fullness, or a "gone" feeling in the stomach; headache, dizziness, nausea, spots before the eyes; tinnitus, deafness: some of the above sensations are also spoken of as feelings; (3) *Feelings or emotions,* such as fear, anxiety, worry, distrust, shrinking; or relief, confidence, happiness; comfort, or discomfort; weakness, faintness, fatigue, vague premonitions of danger; or feelings and desires, expressed in such questions as, "Doctor, when may I sit up?" or, "When may I go home?" indicating returning interests, hopes, strength and general physical and mental well-being. "How do you feel to-day?" is a question frequently asked by the doctor, indicating not only his interest in the patient, but also the significance of the feelings of the patient as an index of his general condition and progress.

Pain is Nature's persistent and almost universal way of calling attention to the fact that something is wrong in the body, and of demanding, as it were, that something be done about it. *Tenderness* is pain or soreness produced by pressure. Pain may also indicate the seat of the trouble, but often it is a referred pain; that is, it is felt in a spot which may be far remote from the seat of the trouble. In this way, pain may be a misleading symptom. It is, however, always an important symptom, at least to the patient, and should be reported and treated promptly. To be relieved from pain is what the patient desires most; and he will go to that person who will treat him by giving relief from pain, even though that person does not reach the seat of the disease at all. This is largely the secret of the success of quacks, and of the cause of failure among doctors who, although they conscientiously seek to treat the real cause of the trouble, ignore and fail to give relief to the annoying symptoms which really drove the patient to him for relief; such relief is to him the measure of the doctor's ability.

Pain varies in intensity, character, area, and duration. It may be described as sharp, acute, dull, or aching; sudden, remittent, shifting, coming and going, continuous, radiating, darting, or paroxysmal; burning, throbbing, stabbing, boring, gnawing, or "colicky"; it may be increased by motion, or relieved by pressure.

Subjective symptoms—sensations, feelings, pain—are usually accompanied by outward expressions (objective symptoms) which will be detected by the observant nurse who really studies and knows her patients. We should not have to rely upon the patient's complaints, and he should be spared, as far as possible, from telling them. As indicated under the objective symptoms listed, one's actions, facial expression, and bodily movements, etc., usually express, and particularly when ill, what one is feeling or experiencing.

WHICH ARE OF IMPORTANCE

It may be said that symptoms, while sometimes misleading, are *all* important, though not equally important, to the nurse. They may be important merely because they concern and occupy the attention of the patient; they may be important because they indicate neglect and inefficient nursing, and call attention to his mental, physical, and social needs; they may be important because they point to the onset, course, progress, dangers, complications, recovery, or prognosis of the disease. The first two should be the concern of the nurse; if not attended to, they may not only be misleading, but may greatly delay his recovery. The last greatly concerns the doctor; but, as he sees the patient infrequently, and for brief periods, he is dependent upon the nurse for accurate observations and reports. Again, a patient will often tell the nurse important facts which he "did not like to tell the doctor," "did not want to bother the doctor with," or "did not think it important enough" to tell him. Such symptoms should always be listened to attentively, and, if important, reported in the words of the patient as far as possible.

Symptoms may be misleading as stated above, and in various other ways. They may be exaggerated by the patient's imagination, or minimized by his shyness and dislike of giving trouble. Often a patient is unable to describe his symptoms, or he may report those having little bearing on his condition and neglect to mention those most important. He may be too ill and weary to concentrate on what the doctor is saying, or he may be confused by the questions asked and give answers which he knows to be misleading. Skillful questioning on the part of the doctor is often necessary to draw from the patient the subjective symptoms bearing on the case, and the answers must be supplemented by the observations of the nurse.

Again, symptoms may be misleading because they frequently manifest themselves in some part of the body remote or seemingly not connected with the seat of the disease. For instance, such symptoms as difficult breathing, or coughing and expectoration, may be due, not to disease of the lungs, but of the heart; a cough may be caused by an abscess in the ear which is causing pressure on a nerve connected with the nerve supplying the lungs, and so giving rise to a "reflex cough." Pain is often a misleading symptom because it may be "referred" or felt in a spot far remote from the seat of the trouble. Physical signs must frequently be relied upon in making a correct diagnosis. The fact that certain symptoms may be misleading is all the more reason that symptoms should be reported fully, accurately, and at the time of their occurrence; a symptom by itself may seem to be of no importance but when associated with others, a group of symptoms, may be very significant, indeed.

To observe accurately, to discriminate, to judge the relative importance, the relationships and significance of symptoms, and to report accurately and concisely, comes only with experience—experience in observing, comparing, thinking, judging, and reporting. But a student nurse, when in doubt, may, and should, always report to a senior or headnurse, and the headnurse, likewise, to the physician in charge. In general, it may be said that any symptom should be reported if *intense or severe in character*, as severe pain; or, if *prolonged* even though not severe; or, if a *departure from normal*, as an increase or decrease in pulse rate; or, if it *tends to recur*, as pain after eating; or, if it shows *progressive development*, as loss of weight; or, if it is a *known danger signal*, as a sharp abdominal pain in typhoid fever; or, if it indicates a *complication*, as coughing following an operation; or, if it points to the *onset* of a disease, as the presence of a rash; or, if it *cannot be relieved by nursing measures*, as failure to eat or sleep, or to void urine, or to defecate over a prolonged period; or, if it *indicates anxiety which can be relieved* by the doctor, relative, headnurse, or social worker; or, if it *indicates faulty hygiene* or *health habits* which cannot be corrected by nursing care, as neglected teeth, faulty mental or behavior habits, the need of eyeglasses, or a more balanced diet; or, if it indicates a *disturbance in function* of any organ or part of the body; or, if it indicates a *change* for the better or for the worse.

Recognition of Early Symptoms Important in Prevention.—*Early* symptoms are *always* important. There are certain serious, but insidious diseases, such as hypertension, arteriosclerosis, cancer, diabetes, and nephritis, which steal on people unawares. If the symptoms of such diseases are observed early, and properly treated, they may frequently, if not always, be prevented. The onset, however, is so insidious that people all too often, even if symptoms are observed, think them of no significance. People should be informed in regard to such symptoms, especially of the importance of the prevention and early treatment of focal infections, and should be urged to have *periodic health examinations.* Too much emphasis cannot be placed upon the rôle of the nurse in this program of prevention through education in which she is recognized, as a health teacher, as, perhaps, the most important factor.

How to Observe

Just as in making a bed, or in giving a bath, one must have a technique, so in observing, it is equally important to have a method or technique. One should have a plan and system of study and work, and an order of procedure covering a period of time, and covering the whole field of observation; this may be an individual patient and his surroundings, a group of patients, a home, or a district in a community. The plan should insure that nothing has escaped the attention of the nurse and that she is thoroughly informed about all that relates to her patients.

For instance, taking the morning as the period of time, and a ward with a special group of patients assigned to a student nurse as the "field," her observations should include the following: (1) Information in the *night report* about the patients in general, but particularly relating to her own patients; (2) The *ward in general*—temperature, ventilation, order, etc.,—but the surroundings particularly of her own patients, and their preparation for breakfast; (3) The *cardinal symptoms*—temperature, pulse, and respiration; (4) *Patients' charts, laboratory reports, the doctor's "order book"; the headnurse's "order book," treatment cards, etc.;* (5) *Breakfast*—service, comfort, enjoyment, amount eaten; (6) *Observations* during and following treatments, medications, the bath, and other nursing measures. The student will budget her time, work, and observations in accordance with the type and severity of the disease, and as each patient's condition and his individual needs may demand. Some patients will require merely general observation and at fairly regular intervals —others may require constant observation; all may have a "temperature chart" with cardinal symptoms observed and charted twice daily—others may have the blood-pressure observed and recorded every half-hour, and may have a complete "symptom record" or "nurse's report" record; some may require special observation of the weight, the diet, the intake and output of fluid, the amount of sleep, or mental and nervous symptoms, with special records of these kept; some wounds may not be observed or the dressings changed for days, while others may be dressed several times daily, and the dressings watched closely for staining and drainage; some may require frequent observation and attention to prevent bedsores, while others may require frequent attention to the lips and mouth; some may have to have their position watched and changed, and their pillows adjusted frequently; some may require nourishment frequently; some may require special observation with certain treatments—such as the application of a mustard paste, light rays, a hot-water bottle, or electric-pad—or with continuous treatments such as baths, or proctoclyses, or with certain medications such as insulin, digitalis, or narcotics; some with casts or splints will be observed for cold or cyanosed extremities; post-operative patients will be observed for bleeding, retention, shock, distention, and other discomforts and complications. Closer, more frequent observations will have to be provided in the plan for all very ill patients, the aged, infants and children, and in all cases where special dangers and complications are feared. The fact that a student gives special attention to her own patients does not mean, of course, that she should not be alert to the observation and needs of others. The appearance and actions of all patients in bed, and also those who are up and walking around, should be observed.

As stated previously, one of the most important observations for the student to make is the record of her own progress and achievement in the power of observation, in skill, and in the spirit, knowledge, and understanding of nursing. A good practice is to try to write observations down later from memory and to check them over with the headnurse. By degrees the student will have learned to observe unconsciously. Likewise, it cannot be too frequently recalled to mind that this technique of observation, like all other methods or techniques, should be based upon knowledge, interest, attention, and, in nursing, upon a sympathetic understanding which enables one to place oneself in the position of the patient. The trained mind is essential. As Pasteur tells us, "In the fields of observation, chance favors only the mind that is prepared."

CHAPTER VI

THE ADMISSION OF THE NEW PATIENT

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY A HOSPITABLE RECEPTION AND REFRESHING BATH

Social Aspects.—Types of Patients.—In a hospital which welcomes to its care people of all nations, of all creeds, rich or poor, infants, children or adults, men or women, there will be many types of patients. They will vary widely in their previous experience and education, in disposition and characteristics, in their prejudices and fears, and in the diseases or accidents from which they are suffering. While all must receive equal consideration, all these factors of racial or personal differences call for somewhat different treatment. Each demands the greatest sympathy, tact, and understanding. All our influence should be brought to bear to reassure the patient and his friends in a time of doubt and anxiety. The patient may be alone or accompanied by one or more anxious friends or relatives. They, too, should receive the greatest consideration, especially, perhaps, in the case of a mother forced to part with an infant or child, leaving him to the care of strangers. In all cases, but especially when the patient is the mother, the father, the wage earner, the family and social aspects should be considered. The attitude and behavior of his relatives have a very marked influence on the comfort of the patient, reacting favorably or unfavorably upon him—calming, soothing and reassuring, or worrying, exciting and making dissatisfied. It is often a trying moment when the friends leave (if the patient is not too ill to care), the patient's impulse being to leave too, if we have not inspired confidence. Sometimes the patient is the calmer of the two and is made much more at ease if his relatives leave, feeling that he is in good hands.

The Patient's Reception and Welcome.—Let nothing interfere with giving him immediate attention. Meet him as though glad to be able to help him, not with indifference, or with a look of, if not words, "Oh, dear! here's another case,"—just so much more work. Make him feel that he is expected and that everything has been prepared for him. Relieve him of all worry and responsibility. Be alert to notice his general condition and strength—whether able to stand, walk or sit, or whether too weak to talk or hold up his head, and note any symptoms which indicate his mental or physical condition. If his friends are not allowed to remain, send them away, but not until they are reassured and satisfied that the patient is in good hands and will receive every attention. Take time to listen to and answer questions; satisfy their desire (which is a very natural one), to see the conditions under which the patient will live. This makes for smooth running, insures a good reputation for the hospital, and goes far to aid in the patient's recovery. Nervous "fussy" relatives are very trying and disturbing, both to the patient and to the hospital.

In many hospitals, patients are admitted first to the Admitting or Reception Ward, which is in charge of a headnurse with a staff of pupils, and the admitting or examining doctor. In some hospitals not provided with an admitting ward, all patients are admitted by the Admitting Office of the Administration Department to the main wards at once, where examination, etc., all take place. The patient is first examined by the doctor, his temperature, pulse, and respiration are noted, a diagnosis is made and directions given for his admission and care. This ward is provided with facilities for bathing, either tub- or bed-bath, and also with beds for the detention of the patient, if necessary, for further observation. It is also frequently near the x-ray room so that it may be used conveniently in making a more accurate diagnosis, when necessary. The doctor gives directions as to whether the patient is to have a bed- or tub-bath in the Admitting Ward, or whether he should go directly to the general ward or not. This depends upon his condition. If an emergency case, or if very ill, he is sent to the main ward and placed in bed immediately. If not too ill, every patient on admission is given a complete bath in the Admitting Ward. If he walks in and his condition permits (his temperature not above 100°, or subnormal, pulse not weak or irregular, or if not suffering from any serious disease such as typhoid, pneumonia, or other respiratory disease) he is given a tub-bath; otherwise a bed-bath is given. He is then well wrapped up and sent to the ward in a wheelchair or on a stretcher. Admission cards, with the patient's name and address, his age, the name and address of a relative or responsible friend, and the diagnosis, accompany the patient to the ward.

If the patient is brought to the ward on a stretcher, place him at once on the bed prepared for him. If the patient walks in, give him a chair. The chair may be beside his own bed (which gives him a more settled feeling, and a feeling of being prepared for), or in an adjoining room, or just within the door, but he should be out of drafts and not inconvenienced by, or in the way of, people passing.

When admitted to the ward, notify the doctor on that service that a new patient for him has arrived. Before the doctor comes the patient should be undressed, his temperature, pulse and respiration taken and recorded, and he should be prepared for examination. It is usually customary also, unless the patient is very ill, to give him the routine admission bath (which every patient receives) before the doctor's arrival.

THE ADMISSION BATH

Purpose and Value of the Bath.—The admission bath is the first step toward restoring the patient to health. The healing powers of water and its beneficial effect on the mind and spirit as well as on the body have long been recognized. Throughout antiquity the purification of the body by bathing has been the symbol of moral purity. Among the Egyptians it was a religious rite, and in the time of Moses bathing was used as a prevention of the skin diseases prevalent at that time. In Palestine (and in all the civilized East) wealthy Jews had baths in their houses, and ponds in their gardens. In Greece, where it was the duty of everyone to be healthy, strong, and beautiful, as told in the tales of Homer, the warm bath served for refreshment and entertainment for the guests, even as it does for our guests, the patients. It was also a religious rite, always forming part of the preparation for a sacrifice, for the reception of oracles or for the marriage rite, etc. In Athens, after the fifth century, B.C., the practice had become so prevalent, the benefits were so universally recognized, that public baths were instituted, as illustrated in so many writings and in paintings on vases, etc. A small fee was charged. At first in Rome, where health and strength of body were among the virtues most admired, there were public baths in every town and village and private baths in every home, heated by hot-air pipes in the basement. These became greatly elaborated, forming one of their chief activities, with gardens, gymnasia, libraries and lecture rooms attached. The remains of these famous Roman baths, sometimes occupying enormous spaces in the heart of cities, may be seen to-day in Pompeii and Rome. They were abandoned in the sixth century, due to the invasion of the barbaric Northerners, whose rude habits and habits of asceticism discouraged the use of the luxurious baths. In the East, among the Mohammedans, they have been retained up to the present, but in Europe, they were long unknown. In the early Christian era, with their ideas of self-sacrifice and of the evil, sinful flesh, which must be mortified and subdued, the bath was neglected, lack of cleanliness being considered a virtue, because it punished and subdued the flesh. In churches and in monasteries, however, the idea of purification by water was retained, in the religious rite of Baptism, as a symbol of moral and spiritual purity.

The custom of bathing used in the treatment and prevention of leprosy and other skin diseases was brought back from the East by the Crusaders.

In England in the 18th and 19th centuries there was much discussion of the bath in relation to the health. Sea-bathing and bathing in mineral waters were again introduced and public baths were instituted in cities and laws were passed, making their use compulsory. In Germany, Italy, and France the baths were never made compulsory, and even to this day in traveling in the country in Italy and France one finds few bathing facilities.

So we see that the bath has always been associated with the prevention of disease and with the preservation of health.

To-day, bathing is a matter of habit or custom and the daily bath is considered, by many, almost a necessity, not only for purposes of cleanliness but for esthetic reasons. A few patients, however, who are admitted to the hospital, object to the bath. Their reasons vary: Some object because they do not think it necessary and are rather insulted at the suggestion; others think too many baths bad for them, or fear they will catch cold, or they "don't believe in them anyway and never take more than a sponge bath." Some patients do not object to the bath but from modesty or reserve (fearing exposure), or from a dislike of being waited on, object to someone else bathing them. A nurse must use great tact in overcoming any objections, and must not be intolerant of prejudices, for most of us have prejudices equally unfounded. The patient will soon learn to appreciate the beneficial effects of the bath. Its purpose and value may best be understood by a study of the functions of the skin.

FUNCTIONS OF THE SKIN

1. The skin is an organ of secretion and excretion of waste products in the form of perspiration and sebaceous matter which, if allowed to remain on the skin, would be irritating, form pimples, and cause a tendency to bedsores. In some diseases, the waste products eliminated by the skin are increased so that the need for cleanliness is greater; in others the skin is not functioning properly and it is necessary to stimulate its function by bathing.

2. The skin is the most important means of heat regulation in the body. The body temperature must be kept normal (98.6°) in order to carry on the functions of the body. The blood in certain organs—the muscles, glands and digestive tract, etc.—becomes heated, by the heat resulting from the chemical processes in the cells, much above what the body needs, and this excess heat, if not removed, becomes dangerous and, if allowed to accumulate, will cause death. This heated blood flows through the numerous blood vessels near the surface in the skin, and as it flows it becomes cooled off by loss of heat through radiation (heat passing to the air) and by evaporation, that is, heat taken from the body to change perspiration (a fluid largely water) into vapor. If this function of heat regulation is interfered with, the body temperature is increased, the body functions are greatly disturbed, and death may follow, as illustrated in the legend of the fair, golden-haired Saxon child who was taken to Rome and covered with

gold leaf to represent a cherub. In disease, this important function may be interfered with. The skin may be cold and clammy because the circulation is sluggish and there is not enough blood and, therefore, not enough heat in the skin to keep it warm and to vaporize the perspiration; in diseases accompanied by fever, the skin may be hot and dry, because the glands are not functioning and heat is not being eliminated by perspiration and evaporation. Bathing will stimulate the functions of the skin so is cooling and refreshing.

3. The skin is an important organ of sensation. It contains many nerve endings and is connected with the brain by many pathways. It is extremely sensitive to touch, heat, cold, pressure and pain, etc., and is constantly receiving messages and sending them to the brain, affecting it favorably or unfavorably, and, through the brain, the functions of the whole body. In this way the bath is soothing and refreshing to both the mind and body.

Method of Giving the Admission Bath.—If the patient's condition permits (when the pulse is strong and regular and his temperature is normal), a tub-bath is usually permitted. The nurse should see that the bathroom is warm, free from drafts, that the bath is prepared at the right temperature (100° to 105° F.), and that everything necessary is in readiness. This includes soap, washcloth, face towel, bath towel, nail brush, comb, nightgown, bathrobe, slippers and stockings, etc. Benzene may be used when the dirt resists the soap and water. A nurse must remember that from the moment the patient enters, he or she is under her care, and the nurse must take full responsibility for her. (An orderly is usually responsible for male patients.) Any assistance the patient may need should be given her. She should not be allowed to remain in the bathroom long alone, and never alone with the door locked. The nurse can keep busy close by, within call and, while not constantly in the room with the patient, should be fully aware of her condition while bathing. She may become chilled, faint, or exhausted, or she may accidentally be severely burned. (A man was recently brought into this hospital who died within a few days as a result of severe burns accidentally received while taking a bath in his own home.) After the bath see that the patient is warmly wrapped and placed immediately in bed.

The body of every patient admitted should be carefully examined for rashes, scratches, burns, or bedsores, etc. Such conditions, if present, should be reported and charted. A rash may indicate that the patient is suffering from an infectious disease. Scratches may indicate the presence of body pediculi. The patient may claim that burns or bedsores, etc., developed in the hospital and this may involve the hospital in a costly lawsuit. The treatment for pediculi will be discussed under the care of the hair. Head pediculi are more commonly met with than body pediculi.

A bath in bed is given if a tub-bath is not permitted. For the admission bath, frequently a large amount of soap and water is needed so that extra protection may be required for the bed. In this case a large rubber is used to protect it. As the bed-bath is a more difficult procedure, and used for very ill patients, it is usually given by an older nurse so will be discussed later.

Care of the Hair

It is usually customary, on admitting a patient to the hospital or ward to include washing the hair in an admission bath. This is always desirable, because it may be weeks before it is possible to wash the hair again and a clean head adds greatly to a patient's comfort. When washing the hair (or when brushing and combing it, if not washed) examine the hair carefully for pediculi. If possible to do so thoroughly without the patient's knowledge, do so; otherwise explain to the patient that, while it is probably an unnecessary precaution in her case, all ward patients must be treated alike. Explain that it is a routine precaution that the hospital has found necessary in order to protect her and all the patients who enter from the possibility of infection. Daily examinations should also be made because of the danger of pediculi being carried in by visitors and the ease with which the infection spreads.

Pediculi, or lice, are blood-suckers and parasites which live on the human body. They are found on the hair or on the hairy portions of the body.

There are fifty or sixty known species. Those which are sometimes found on patients in the hospital are:

1. Pediculus capitis, found on the hair and scalp. The eggs or nits are seen as white specks, many on a single hair, and look like dandruff, but cling tenaciously, and cannot be shaken off or removed by combing.
2. Pediculus corporis, the body louse which lives on the clothing and body, causing minute, hemorrhagic specks, and itching about the neck, back, and abdomen; scratches on the body are very suspicious.
3. Pediculus pubis or crablouse, found on parts of the body covered with short hair, especially the pubes.

They are *harmful* and *dangerous* because they carry filth and are a source of discomfort to the patients, making them nervous and restless. They cause the patient to scratch and these scratches sometimes become infected, causing abscesses. They are a source of disease; they are blood-suckers and cause anemia, and they also cause enlarged and infected glands; they are a source of infection, spreading skin diseases, typhus fever and trench fever. They spread rapidly on linen, blankets, bedding, towels, combs, brushes, and other articles. They may be carried by flies.

Pediculi may be detected by the habit of scratching, by the presence of scratches and hemorrhagic specks on the body, or they may be seen on the hair, pillows, clothing, or bedding.

To *prevent or remove pediculi,* the clothing, body, and head of each patient must be examined on admission and the head should be examined daily. Particular attention should be given after visiting days as they are frequently carried in by visitors. Note any scratches on the body or habit of scratching. An infected patient, his clothing, linen, comb and brush, etc., should be kept isolated as much as possible. In large hospitals, where patients come unprepared with their own combs and brushes, ward combs are used; particular attention is paid to the manner of their care and daily disinfection. Brushes for general use should not be permitted.

To *destroy and remove head pediculi,* apply tincture of delphin, larkspur, delphin and ether, or kerosene to the hair, and wrap the head up closely and securely in a towel. Leave it so for from eight to twelve hours, then wash and fine-comb it. Grease may also be used, as pediculi will not live in it. The eggs or nits are very difficult to destroy. Hot vinegar and soap, or kerosene will help. The hair should be fine-combed daily and fresh applications made if necessary. Kerosene is seldom used in the hospital because it is very irritating and may blister. It is usually diluted with oil and should be used with great care.

In bathing the patient if *body pediculi* are found or suspected the condition should be reported to the doctor who will give the necessary orders. To *destroy body pediculi* the infected parts of the body are shaved, if necessary. The patient is given a bath in a 1:5000 bichlorid of mercury solution, and blue ointment (a mercurial ointment) is applied to the infected parts. The clothing should be boiled or sterilized by steam under pressure, if it will stand it, or by dry heat, or fumigated with sulphur fumes. The latter is not very effectual.

The method of washing the hair may be a tub or bed-shampoo. The principal points to observe are given in the care of the hair in the morning toilet, Chapter VIII. When the patient is allowed a tub-bath on admission, he (or she) is frequently able to wash his own head. The nurse must see that everything is convenient for him, and that he is given any assistance necessary and that he does not become exhausted.

RESPECT AND CARE FOR THE PATIENT'S PERSONAL BELONGINGS

However poor, ragged or old, dirty or shabby the patient's clothing may be, they are probably the best that he has, for he will no doubt wear the best he owns unless too sick to care. If they are shabby, he will probably be very sensitive about them, but no word or look should indicate that the nurse is conscious of their poor condition. However shabby they may be, he or she will not like and cannot afford to have them lost or carelessly handled. They should be treated with the same care as one's own most dainty and costly belongings. Articles lost must be replaced by the hospital, and such carelessness earns for the hospital a bad reputation for carelessness and mismanagement and renders the inmates liable to suspicion—patients have been known to suspect nurses of taking money or valuables. Some articles cannot be replaced, and their loss causes the patient great inconvenience and unhappiness. Lost articles are a constant source of trouble.

Wherever possible, it is advisable, if the patient is accompanied by relatives, to have them take the clothes, and especially any valuables, such as papers, jewelry, or money, home at once. A complete itemized list of everything belonging to the patient, retained in the hospital, must be made. Before or immediately after undressing the patient, remove everything from the pockets, make an itemized list, check it over with the patient (if not too sick), have him verify and sign it. Tie the articles up in a separate package with the list and carefully mark with the patient's name, the name of the ward, the date, and the nurse's signature, and give at once to the headnurse, who will transfer it to the safe kept in the office for that purpose. A receipt is given to the patient or kept by the headnurse.

Before putting the clothing away, examine it carefully for pediculi, especially in the seams. If articles of clothing are found to be infected or very dirty, it may be necessary to burn them, the hospital supplying others in return. (First explain to the patient if his condition permits.) If not infected, they are neatly folded, listed, wrapped in a bundle, carefully tagged with the date, name of the patient, the ward, and the nurse, and sent to be fumigated or sterilized. The clothing of a patient suffering from an infectious disease is treated with similar care. If pediculi are found on the clothing the condition is reported to the doctor who will give orders for the necessary care of the body. The care of body pediculi and infected clothing are discussed under the care of the hair.

The provision for the care of clothing varies in the different hospitals. In some cases, equal, if not better care, is given than they would receive in the patient's home. They are cleaned and pressed and all the outer garments—coats and dresses, etc., are hung up carefully on hangers. All clothing is kept under lock and key. This scrupulous care of the clothing must have a very far-reaching effect, contributing to the high standards of personal hygiene set while in the hospital. It is said that the way to keep a man out of the mud is to blacken his shoes.

Whatever system is used, an itemized list of all the clothing and valuables should be kept. This list should be signed and verified by the owner, and by the nurse, and should be listed in the clothes book or similar record kept for that purpose. It should also be signed and verified by the headnurse.

CHAPTER VII

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY MENTAL AND PHYSICAL COMFORT

From the time the patient is duly admitted to the ward, to make him as comfortable as possible in mind and body is one of the first and most important factors in the nursing care. His recovery will depend to a large extent upon his comfort, and this will depend almost entirely upon the nursing care. In order to make him comfortable a nurse must understand what constitutes comfort and must become skilled in observation, in sympathetic understanding and response to mental and physical needs, and in moving, turning, lifting and supporting, and in other ways of making patients comfortable.

What Constitutes Comfort.—"To comfort" as defined in the dictionary means to strengthen, support, invigorate, refresh, gladden, cheer, and to give relief from pain and trouble. It means a mind at ease, with congenial occupation and diversion, and free from care or worry. It means a body free from pain, hunger, cold, fatigue and annoying symptoms and discomforts of any kind.

The Importance of Comfort in the Care of the Sick.—*Physical rest and relaxation* conserve the energy and build up the resistance to disease. It is absolutely essential to the recovery of the patient and to the success of many therapeutic measures. *Happiness and contentment* also promote recovery. They mean mental rest and relaxation and this puts the body in the best condition to conserve its energy and to resist disease. When the mind is depressed or overstimulated by painful emotions the body cannot function properly. Someone has said that such emotions as excitement, anger, fear, and worry are like strong, hypodermic injections of highly poisonous drugs. They have a very injurious effect on the body and interfere with digestion, the secretion of glands, the action of the heart, circulation, and respiration, and all the other functions of the body.

Happiness and contentment have also a definite social value whether the patient is in a private home or in the hospital. They make things run much more smoothly and this in itself aids in the patient's recovery. They also add to the good reputation of both the nurse and the hospital. The ability to make her patient comfortable, happy, and contented is the chief mark of a good nurse and is essential to the success of every treatment. After every treatment or procedure a nurse should ask herself, "Is my patient comfortable?"

Causes of Discomfort in Illness.—Physical Causes may be:

1. *The Position of the Patient.*—The discomfort may be due to cramped, strained, and tired muscles from lack of support, slipping down in bed, straining to reach the table or bell, pillows disarranged or not properly adjusted, or it may be from lying too long in one position.

2. *Weight and Pressure on Sensitive Parts.*—This may be the patient's own weight: The weight of his arms resting on his chest or abdomen, the weight of his limbs crossed and resting on each other when he is too weak to move, the weight of the body and pressure on the buttocks when sitting up, the weight of the head on the chest when not properly supported, the weight of the body lying on one arm, the weight and pressure on prominent bones, the weight of the bedclothes on the chest, abdomen or painful extremities as in burns, ulcers, sprains, fractures, and rheumatic joints, and it may be pressure from casts, splints, or tight bandages.

3. *Friction, rubbing and chafing* from restlessness, constant turning, friction of the bedclothes, or moisture, crumbs or wrinkles in the bed.

4. *Extremes of Temperatures.*—Discomfort from heat may be due to a high body temperature, or to the heat of the surrounding air or to too many bedclothes. Discomfort from cold may result from lack of heat production in the body, or poor circulation, or from cold air, drafts and too few bedclothes. Moisture in the atmosphere, or on the body (perspiration), and damp clothing all cause chilling and discomfort.

5. *Interference with Bodily Function and Annoying Symptoms.* Sleeplessness, or an irregular, broken sleep, loss of appetite, indigestion, constipation, nausea, vomiting, and weakness from unused, weak and flabby muscles resulting from lack of fresh air and exercise, all cause discomfort.

6. *Lack of cleanliness*, irritation of the skin, itching, aches and pains are frequent sources of discomfort.

7. *Unskilful handling*, and sudden, jerky, clumsy, noisy, startling, and unsteady movements are among the common sources of discomfort.

Mental Causes of Discomfort may be:—Strangeness, homesickness, worry about finances and home conditions; shyness, sensitiveness, apprehension and fear of pain, suspense, uncertainty, monotony, restriction of personal freedom, exposure, lack of privacy, and being treated as a "case" or as a child and not as a rational human being; too much light and noise, pain and distress of others, odors, vomiting, and complainings, lack of system, disorder, delays, confusion, and mismanagement. Lack of interests is a common cause of discomfort. The sudden cutting off of normal, active mental occupations and varied interests leaves a blank and forces the mind to feed upon itself, for the mind is so constructed that it must pay attention to something. A mind feeding upon itself is not a healthy mind, and soon becomes depressed, morbid, and self-centered and the patient becomes interested only in what directly concerns himself. He is apt to worry and complain about his meals, his dressings, and general care, and to feel that he is not receiving enough attention.

Means of Securing Mental Comfort.—We should try to make patients feel at home, or at least that they are among friends, and should try to relieve them of any worry regarding their home, by placing them under the care of the Social Service Department. We should try to inspire confidence in the hospital and staff, making them feel happy and contented, and confident that the hospital, doctors, and nurses are quite competent to look after them. Patients should never have to worry about their care—that is what nurses are there for. This is one of the first principles laid down by Florence Nightingale who observes: "It is commonly supposed that the nurse is there to spare the patient from making physical exertion for himself—I would rather say that she ought to be there to spare him from taking thought for himself. And I am quite sure that if the patient were spared all thought for himself, and not spared all physical exertion, he would be infinitely the gainer." "In the hospital it is the relief from all anxiety, afforded by the rules of a well-regulated institution, which has often such a beneficial effect upon the patient."[1] We should never trouble the patient with our difficulties or complaints and should refrain from discussing such matters as mismanagement or lack of experience on the part of his nurse, lack of time or of nurses, or of supplies. We should never allow him to feel that there are difficulties to interfere with his proper care. A nurse should not look to the patient for sympathy because of hard work, long hours, or criticisms for faults found in her work. She should make him feel that she does things for him because they will help him and because she wants to do them, not because she is told to do them. The surest way of making patients happy and contented is by being so ourselves. A nurse should not be so occupied with the appearance of her work, irritated or afraid of criticism if it is upset, that she makes the patient afraid to turn or relax properly. But a certain amount of wholesome fear of criticism for untidiness or lack of cleanliness is good for both patient and nurse.

A nurse should not make the patient feel that she has so much to do that he is afraid to ask for necessities, such as a bedpan, until the need or desire is past. Patients are often too shy and sensitive to risk displeasure and it is true that some unscrupulous nurses take advantage of this. We must remember that the patient is a human being with needs and feelings like ourselves. We should treat him and his friends as we would like our mother or sister to be treated, or as we see the patient prefers. For we must remember that people differ in the way they like to be treated and in what they consider attention or neglect. Some are sensitive and reserved, like to be left alone, not "fussed over," and are embarrassed and irritated by too much attention. Others like constant attention, like to be pitied and never left alone—think you are heartless if you leave them and are even jealous of attention to others. We must consider and indulge the feelings of each where possible without overindulgence or neglect of others. A nurse should try not to distress a patient by forgetting and making him repeat his requests, or likes and dislikes. This is very tiring and disappointing. She should not forget to post his letters, for instance, whether important or unimportant; this forgetfulness may keep him awake for hours. She should not make a sensitive patient request assistance a nurse should see for herself is needed; for instance, placing a bedside table and drawer within easy reach, placing the tray with food conveniently, lifting, turning, changing his position in bed, shaking and turning his pillows, replacing soiled damp gown or bedding for clean, dry linen, protecting from drafts, pulling down the shade to prevent light from shining in his eyes, not allowing him to sit up too long or until fatigued, protecting with a screen from distressing sights around him, or giving the bedpan at regular intervals or when desired, etc. Some patients will ask for what they want; others are too shy, indifferent or sensitive. They "hate to give trouble" while others expect attention without asking for it; that is, they expect a nurse to know her business. In nursing, one must avoid an air of mystery but one must also avoid telling the patient by word or look his condition, temperature, pulse, or respiration, or what medicines, etc., he is getting. And while it is necessary to cheer a patient one must not do so by raising false hopes, by telling him untruths, or by making light of his illness. It is natural for the patient to ask such questions, and the nurse should show tact and understanding in dealing with them. There will be no difficulty if she merely informs her patient that the doctor is the only one who answers such questions, but she should dispel all ungrounded fear regarding treatments ordered by the doctor.

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[1] Florence Nightingale.

"Do, you who are about the sick, try and give them pleasure, remember to tell them what will do so." "A sick person does so enjoy hearing good news:—for instance, of a love and courtship, while in progress to a good ending." "A sick person also intensely enjoys hearing of any material good, any positive success of the right." "Do . . . tell him of one benevolent act which has really succeeded practically—it is like a day's health to him." "They don't want you to be lachrymose and whining with them, they like you to be fresh and active and interested, but they cannot bear absence of mind, and they are so tired of the advice and preaching they receive from everybody, no matter whom it is, they see."[1]

"There is no better society than babies and sick people for one another." "An infant laid upon the sick bed will do the sick person, thus suffering, more good than all your logic. A piece of good news will do the same."[2]

This effect of a baby on the sick is sometimes seen in a surgical ward when a mother has undergone an operation and her baby is brought to her to be nursed. The whole ward seems stirred and brightened to a cheerful, tender, kindly feeling and each patient strains to see or hear all about the baby. Even the most seriously ill and exhausted are aroused to a tender interest and to new hopes. Even if the baby cries it does not seem to disturb or annoy but causes only a feeling of solicitude for its comfort and happiness.

Never tell or read a story which will either depress or stimulate and excite, and which tends to make the patient argue, or which in any way taxes his mind. One must remember the patient is always below par mentally as well as physically, and soon tires with talking or reading. The only object in talking or reading to a patient is to divert and give him something pleasant to dwell upon, and not something which will excite or set his imagination working and keep him awake for hours. One should never attempt to read or tell funny things to a very sick patient —how can anything seem funny to the very sick? It only sounds heartless.

A nurse should try to relieve the *monotony* which is one of the main sufferings of illness. "The craving for variety in the starving eye is just as desperate as that of food in the starving stomach, and tempts the famishing creature in either case to steal for its satisfaction." The love of beauty, of variety and color, the longing to escape from the confinement of four walls, to see out of the windows, to see the trees, green grass or water, to see young, playful things, and to be able to gaze off into the distance becomes almost insupportable. There is a great sameness in the hospital from day to day. The very system and routine upon which its efficiency depends make it so. Even the nurses' uniforms, while generally admired because fresh, neat, and clean, seem to get monotonous,—I have heard patients say they thought it would be "nice" for the patients, if the nurses did not all wear the same, but wore different dresses of different colors and made differently. Whenever it is possible, monotony should be relieved by removing the patient to the balcony, to the lawn, or to the window, or by showing them beautiful pictures of trees and flowers, of the sun and water, or of children—something to refresh and rest the mind. When the patient is well enough, she should have a little manual occupation—knitting, sewing, making supplies or playing games, etc. The value of manual occupation, of keeping the fingers and the mind occupied, has been well demonstrated in the late war in restoring the sick soldiers to health, both mentally and physically. Nurses should try to remove the feeling of *strangeness*. We know ourselves, for instance, how difficult it is to sleep in a strange bed, or to adjust ourselves to different surroundings or people, and this the patient is in no condition to do. A nurse should see the patient has as much *privacy* as possible by screening the bed when the patient is very ill or when she desires to rest or sleep, and for all treatments. Some patients are sensitive and do not like being observed when taking medicine, getting dressed, trying to walk, getting up or back to bed, trying their strength by walking, etc. A nurse will often be surprised to find these done on her return, and will wonder why the patient did not wait for her to help him.

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[1] Florence Nightingale.

[2] Ibid.

Noise is most wearing and distressing to the sick. Nurses should avoid sudden, sharp noises, rattling windows, and dishes, etc., rustling uniforms, creaking shoes, flapping of blinds and curtains. They should avoid whispering in the room or outside the door and should avoid a long conversation in the corridor when the patient is expecting his nurse each moment to enter—I have known a nerve specialist to keep the patient waiting in this way intentionally when he wished to see the patient at her worst. A nurse should avoid a conversation in the room with others in which the patient is not interested, or to which mind and body are too weak to attend. All unnecessary noise is cruel to the patient. Nurses should try not to forget things—this means opening and closing doors too often; they should never walk on tiptoe—this makes the patient self-conscious and is injurious. One should avoid hurry and bustle, but be efficient and quick in carrying out requests. The patient should not be startled by a sudden entrance, by a sudden announcement, by someone speaking suddenly, unexpectedly, from behind, from a distance, or when he is otherwise occupied. "Don't let the patient be wearily waiting for when you will be out of the room or when you will be in it." A nurse should never show doubt, hesitation, uncertainty or indecision in her movements or speech and should remember that she is there to plan, to remember, to decide for the patient, and to relieve him of all responsibility.

The effect of visitors depends upon the visitor and the patient's condition, and can only be judged after the visitor has gone. It is most important to see that the right visitors are admitted. They should be given a chair; one should never stand while conversing with a patient or seem in a hurry to get away. The chair should be placed conveniently and near the bed, where the patient can hear and see without straining. The patient should be in a comfortable position for conversing. The visitor should be warned against leaning against, sitting upon, placing articles upon, shaking, or striking the bed for the patient feels the jar all through. Patients should be allowed as much privacy as possible when friends are present, and all treatments should be arranged, if possible, so as not to interfere. Visitors should be prevented from giving the patient any food, etc., that he should not have. He must not be allowed too many visitors and they must not be allowed to tax the patient's strength by staying too long.

We must remember that what to the well should be a trifling annoyance soon forgotten may be to the sick a source of prolonged suffering, delaying recovery, or hastening death.

Means of Securing Physical Comfort:

1. By Changing the Position of the Patient.—We must remember that even the most comfortable position will become unbearable if the patient is forced to remain in it for any length of time. The patient's position, whenever his condition will permit, should be changed frequently. The usual position in bed is the *dorsal recumbent,* that is, lying on the back. When in this position, the pillows should be arranged so as to support the weight of the shoulders and head, without pushing them forward on the chest: Such a position besides being strained and uncomfortable, producing a cramp in the neck, also interferes with breathing. When the patient is lying on his back the strain on the *muscles of the back* (particularly in the hollow or small of the back, as the weight of the body rests on the shoulders and hips owing to the curves of the spine) and the strain on the *abdominal muscles* from the pull and weight of the outstretched limbs are very severe and painful and soon become unbearable. Again the strain in the *hollow of the knee,* due to the pull on the tendons when the leg is outstretched, may become agonizing. The strain on the muscles of the back may be relieved by supporting it, filling in the hollows with small pillows, small pads, or a hot-water bottle partially filled with warm water. Patients who are strong enough will support this part with their hands, a book or pillow from under their head, or by stuffing the bedclothes or anything in the "small" of the back to relieve the intolerable strain. The strain on the abdominal muscles and tendons under the knees may be relieved by flexing the thighs and knees and supporting them with a bolster, a folded pillow, or a special device. All hollow places should be filled in. One of the best ways, and most delightful to the patient, of relieving strain and fatigue of the muscles due to position is by stimulation of the circulation by massage or rubbing the back and legs with alcohol. The fatigue is due to poor circulation—the accumulation of waste products and lack of fresh food supplies. The massage moves the waste blood along and fresh blood takes its place. When lying on the back the weight of the patient tends to drag him down in bed, making his position uncomfortable. His pillow should be shaken and straightened and the patient lifted back into a comfortable position. *To lift up in bed,* when at all advisable, two nurses should lift the patient. They may stand on the same side or on opposite sides. One nurse should support the head, shoulders and back by placing one arm across the back to the opposite axilla, and, with her free hand, lifting and arranging the patient's head so that it will rest comfortably on her arm, the other arm being then pulled across the small of the back. The second nurse places an arm across the back, the other arm under the thighs. Flex the patient's knees, have him place his feet firmly on the bed, and press when being lifted—both nurses must lift together. When it is not necessary to support the patient's head, the nurses may clasp hands behind the patient's shoulders and beneath the thighs and, lifting him from the bed, gently swing him into position. The patient may place an arm around the shoulders of each nurse for support. Have him press with his feet on the bed as before and all lift together.

To Turn on One Side.—Again, the back and legs, etc., may be relieved by turning the patient on her side. In doing so, see that the head, shoulders and hips are properly adjusted, and that the neck, shoulder and arm are not cramped. Also see that the weight of the body is not on the arm, and that the legs are flexed at the thighs and knees. The weight of the upper leg should not be on the lower—it should be flexed a little more, with a pad or pillow placed between them. The back should be supported its whole length with pillows so that the patient can comfortably relax. A small pillow in front of the abdomen for the patient to lean against, with slight pressure, gives great relief and comfort, especially when the patient is suffering pain from gas in the stomach or intestines. See that the patient, when turned, is not too near the edge of the bed—she might fall out, especially when asleep. Even if there is no danger, it may be alarming to a nervous patient.

In turning, moving and lifting, etc., a weak and helpless patient should be protected from all unnecessary exertion. To turn such a patient toward you, place one arm obliquely across his back extending from the far shoulder to the side nearest you and the other arm in the same way around his hips; then lift and draw him slightly backward and at the same time turn him gently and smoothly toward you. Then make the necessary adjustments as suggested above. To turn him from you, slip one arm from the side nearest you under his back to the far shoulder, and place the other around the hips in the same way. Then lift and draw his far side slightly toward you so that he is gradually turned away from you.

When patients can turn themselves without injury, it is better to allow them to do so. For instance, when movement causes pain as after an abdominal operation, the patient may prefer to turn himself and can do so with greater ease and comfort. He will turn very slowly, first one part of the body, then another, instinctively making those adjustments which cause the least pain. A nurse may gather many useful hints by intelligently observing how such a patient turns and adjusts himself. It is good for patients to help themselves when their condition permits.

To Sit Up in Bed.—Sometimes at the beginning of convalescence, when the strength is gradually returning, the patient is allowed to sit up for a short time only. Again, the patient may be obliged to sit up night and day because of a difficulty in breathing, as in certain diseases of the heart and with congestion of the lungs. This condition is called orthopnea. When sitting up, the pressure of the abdominal organs does not encroach upon and embarrass the action of the heart and lungs as when lying down. The diaphragm is more easily depressed and more room is allowed for chest expansion. Comfort in this position may be secured with extra pillows, with a backrest (securely tied to the head of the bed) and pillows, or with a Gatch frame—an adjustable frame by which the patient may be supported in a sitting position with the thighs and knees flexed and supported at any angle desired. When the patient is still weak and is allowed up for a short time only, it is important to avoid all effort, strain and exhaustion. There must be no jerking or pulling in the effort to lift up so that the poor patient becomes exhausted in the effort and can't enjoy the treat, long looked forward to, of a change in position, or being able to look around, or out of the window, etc. Have a second nurse assist you if necessary. Have everything necessary at hand and in a convenient position. Support the patient throughout the adjustment of the pillows or backrest—it must be done quickly and expeditiously. See that the shoulders are protected with a nightingale or chest protector. The patient's resistance is lowered and the exposed neck, chest and shoulders with their large blood vessels are very sensitive to cold, or to a change in the temperature, and, if exposed, may chill the whole body and further lower his resistance. The number of pillows required varies with the position, the patient's condition, the means of support, and the length of time the patient will be sitting up. If only during meals, the two pillows on the bed alone may be arranged to elevate sufficiently. The pillows may be arranged upright, crosswise, or both. In all cases see that the head, neck, back, and arms are properly supported with no "crook" in the neck, no hollow in the small of the back, the head not thrown forward on the chest, the shoulders not forward with rounded back and hollow chest, making it difficult to breathe: The shoulders must have room to fall back, and the chest room for expansion. There is nothing more distressing to the patient and the observant onlooker if this is disregarded. Also the arms should not hang unsupported with their weight dragging on the shoulders and chest; neither should they be allowed to rest across the chest or abdomen: Their weight becomes extremely oppressive and unbearable. Arrange the pillows so as to support the full length, not forgetting the wrist and hand. Especially support the arms when weak or edematous. Flex the thighs and knees; support them with a bolster, pillows (tied to the head of the bed), or other device under the knees to prevent the patient from slipping down in bed.

Remember that when the patient is sitting up for the first time or when weak, this change of position is a great tax on his strength. The heart and circulation may not have time to adjust themselves to the change, so that sufficient blood does not circulate through the brain to maintain consciousness, and the patient may faint. Do not leave him alone for many minutes. Take the pulse before and shortly after the patient is up, and note his color and facial expression. Don't allow the patient to become pale, weary, fatigued, and exhausted; don't wait for the patient to plead to be "let down"; don't use up his last ounce of strength (lowering him again is in itself an exertion and a strain), but leave him with a feeling of refreshment and pleasure. Shake and turn his pillows, massage his back and make him comfortable. A hot drink will help to revive him if feeling weak.

The Use of a Bedside Table in Dyspnea.—Patients obliged to sit up in order to breathe with any comfort, usually breathe more easily when leaning forward. In this position the pressure of the mattress against the posterior chest which interferes with the expansion of the lungs in the posterior chest is relieved and the chest can expand more freely. It removes the obstruction, gives energy, and gives more air to the smothering patient. The slightest pressure may interfere—the weight of bedclothes, of a mustard paste, poultice, hand or arm. Pressure which would be insignificant in health may seem like a mountain, and every effort to breathe like trying to move it, with a tremendous strain on the muscles and strength. To support the patient and allow him to relax, place a tray with a soft pillow on it in front of the patient for him to lean upon and press pillows against the lower back for support. Guard against chilling—the lungs are already congested and the chest sensitive to cold. These patients are always in a critical condition—watch them carefully.

When the patient is in the usual sitting position, the full weight rests on the buttocks and end of the spine. Great care must be taken to relieve the pressure by the use of rubber rings, etc., and to keep the part in good condition by keeping it clean and dry and stimulating the circulation by massage in order to prevent pressure sores.

To Sit Up in a Chair.—As the patient's strength increases she may be allowed to sit up in a chair—to strengthen the muscles and gradually regain strength, to get used to the sitting position without feeling faint, and to provide a change of position. It is a treat for the patient to get out of bed, to feel the feet hanging down, and resting on the floor for even a few moments. This allows the bed to be aired, the mattress turned, and the bed remade.

See that the chair is comfortable, in good repair, protected with cushions or pillows, and placed conveniently (at right angles to the bed) for lifting, or helping the patient in and out, so that neither the patient nor the nurse will need to take any extra steps.

See that the patient is well protected with dressing gown, stockings, slippers, and blankets to suit the weather and his condition. Allow no exposure in dressing. In lifting him into the chair do so gently and gradually, without jerking or straining. In order to do so have someone to assist you, both to avoid unnecessary strain upon yourself or the patient, and to give the patient a feeling of security. Otherwise both patient and nurse may be breathless and exhausted after the effort. When patients have been lying down for a long time and their position is changed, as in sitting up in bed, or in a chair, or in standing, it takes time for the circulation to adjust itself, for position has a great deal to do with the supply of blood in the brain. People instinctively assume the position not only which gives them the greatest comfort, but which either soothes or makes the brain more active. For instance, when we wish to think we instinctively do something to increase the blood supply in the brain. Some walk about so that the heart and circulation are stimulated. Others do their best thinking when lying down, for instance, after they have gone to bed, and say they wish they could remember in the morning all the poetry or wise things they thought of before going to sleep. Again when the brain has been active (increased blood circulating in it) many cannot sleep unless the head is elevated by two or more pillows:—Everyone has, no doubt, had the annoying experience of being obliged to sit up in company when he could hardly keep his eyes open, and yet when at last in bed has found it impossible to sleep for hours. This is due to the effect of position on the circulation of the brain. A sudden change in position which lessens the blood supply in the brain may cause the patient to faint.

Raising the patient's head or body suddenly, then, may cause her to faint because the blood remains in the body, leaving the brain anemic. Dr. Brunton relates that in Paris, before the use of chloroform as a means of producing anesthesia, or loss of consciousness, it was customary to suddenly raise the patient from the recumbent position, the head being raised so quickly the blood had no time to follow it, so that the brain became very anemic and loss of consciousness resulted. Another very serious condition which may develop when the patient is allowed to sit up or move about for the first time is the formation of an embolus. During an operation many blood vessels are cut. The bleeding is checked by the formation of clots. These clots may be in blood vessels where they do not obstruct the flow of blood and so do no harm. But when the patient sits up the heart must work much harder, and the pressure of blood is much greater. A clot may be dislodged and carried along to a vessel in the lungs, the brain, or walls of the heart where it completely obstructs the circulation and supply of blood to the tissues. This may mean instant death. A clot of blood in a vessel is called a *thrombus*. When it is set in motion and obstructs an important blood vessel it is called an *embolus*. The condition is called *embolism*. The patient may die, for instance, from pulmonary embolism.

Lift the patient then with great care. Remember that the muscles are very weak from lying in bed. Do not allow him to stand, or if so, only for a few moments, for standing is the most trying position. When in the chair see that he is well supported, with no hollows in the back, that the head is comfortable, that the feet and legs are snugly and neatly wrapped in the blanket, that a foot-rest is provided to keep the feet from the floor where there is apt to be draft; that a hot water bottle is provided for the feet if necessary; that the arms are free (if not too cold) and provided with arm-rests, that the chest is protected; that the patient is not sitting in a draft or in the way of people passing and that the chair is conveniently placed near the table or near the window, etc. If the legs are edematous or ulcerated, or the joints are painful, keep the limbs elevated.

Count the pulse before and after the patient is in the chair. Watch for the slightest signs of fatigue. Don't wait until the patient is exhausted before putting him back to bed so that he is "all of a tremble," so weak that he is "ready to cry" with fatigue or too tired to eat or too nervous and exhausted to sleep. What should have been a treat and benefit to the patient may set him back because of a careless, unobservant, unintelligent nurse. A patient is seldom allowed up for more than one-half hour for the first time, and even less than that if fatigued.

While the patient is in the chair, the mattress may be turned and the bed aired and re-made, or the clothes may be straightened and made ready for the return of the patient.

To put the patient back to bed, observe the same care as when lifting into the chair. Undress him without exposure; make him thoroughly comfortable and allow him to rest quiet and undisturbed. Chart the rate and character of the pulse, the time allowed in the chair, and the effect on the patient.

To Lift a Helpless Patient.—One nurse alone should never try to lift an adult because of the danger and strain on both nurse and patient. Few patients have confidence in the strength of a nurse, and while they may laugh during the effort, they may really be excited and alarmed and this is injurious. Two nurses at least (or a nurse and orderly) should lift together and when carrying should keep step to avoid sudden, jerky, jolting movements. Hold the patient securely, not sagging in the middle of the back and not as though he might fall any moment. One nurse should support the head and shoulders (by placing one arm across the back, the hand extended to the axilla and the patient's head resting comfortably on your arm) and the back, while the second nurse supports the back and the limbs, one arm being placed under the back, the second under the flexed thighs and knees. When *lifting up in bed* both nurses may stand on the same side or on opposite sides; when *lifting to a chair*, both stand on the same side.

When lifting save the muscles of your back and allow the shoulders to bear the weight. Bend the knees slightly, but do not bend the back—bend from the hips. Always move a patient to the side of the bed before attempting to lift him from it. While strength is necessary in lifting easily, it is largely a matter of skill; that is, knowing how to use your muscles to the best advantage.

To Turn the Mattress with the Patient in Bed.—When the patient is in bed for a long time the mattress may become uneven or uncomfortable so that it becomes necessary to turn it, or to change it, or to move the patient to another bed. The mattress may be turned or changed easily and with no discomfort to the patient. *One method* is to remove the pillows and all the top clothes except the sheet and blanket which are folded back neatly over the patient. The under linen is rolled toward the patient, making a firm roll on either side. Two people, one on either side, by this roll lift the patient free of the mattress, while a third assistant draws the mattress out from the foot, turns, and replaces it. A *second method* is to arrange the clothes as before, to lift the patient to one side of the mattress, to draw it from the side partly off the springs, to place pillows on the springs, to lift the patient on to the pillows, and then to turn the mattress (from the head toward the foot), after which the patient is lifted on to the mattress; the pillows are removed, and the mattress placed in position. The bed is then remade. If the mattress is to be changed, the patient is lifted to one side of the old mattress as before and the mattress is partly drawn from the springs. The new mattress is placed on the springs exposed, the patient is lifted on to it, the old mattress is entirely removed and the new one put in position. The patient is moved to the center of the bed which is then remade.

To Move the Patient from One Bed to Another.—Place the beds (if of equal height) close together, loosen the draw sheet and draw the patient to the fresh bed by pulling him on the draw sheet. When the beds cannot be placed together the upper sheet and blanket may be rolled snugly around the patient, who may then be lifted and carried to the fresh bed prepared for him. Both nurses stand on the same side, one supporting the head, shoulders and back, the other the back, thighs and feet. First draw the patient to the edge of the bed, and together lift gently, the patient holding himself stiff.

To turn or change a mattress or to move a patient from one bed to another, in many cases it is less alarming and fatiguing for the patient and more convenient for the nurse to lift the patient and make him comfortable on a stretcher during the procedure.

Position of the Extremities.—Frequently—in rheumatism, phlebitis, ulcerations, painful joints, sprains or fracture—one or both limbs may be elevated in order to improve the circulation and relieve congestion of blood and pain in the part. In moving or elevating an extremity, move it very gently and support its entire length evenly leaving no hollows. In all cases, but particularly in rheumatism in which the slightest movement, jar of the bed, or movement of the floor, or weight of the bedclothes, may be extremely painful, move with the greatest care. It is often necessary to immobilize the part by the use of casts, splints, or sandbags, and to protect from the weight of the bedclothes by the use of a cradle.

Phlebitis (inflammation of a vein) usually attacks the femoral or the great saphenous veins in the leg as in typhoid fever or in other infectious diseases, and in surgical cases. It is usually associated with a thrombus or blood clot as the blood tends to clot when the lining of a blood vessel loses its smoothness. This blood clot (as previously explained) if dislodged and set in motion (then called an embolus) may find its way and become lodged in a small artery in one of the vital organs,—the lungs, heart or brain—thus forming an obstruction or cutting off the blood supply. The result is very sudden death. The chief care on the part of the nurse, therefore, is to keep the part very quiet so as not to disturb any clots. *The part must never be rubbed,* even though the patient feels it might give relief. The part is elevated and an ice-bag is usually applied to relieve the congestion. Sandbags are frequently used to limit motion.

2. By Preventing and Relieving Discomfort from Weight and Pressure on Sensitive Parts.—Do not allow a weak patient to be obliged to support his own weight—his head, arms, or body when sitting up or when turned on one side. When the skin is tender and the patient thin and emaciated support the weight of the body and protect all bony prominences by the use of air-rings or cotton rings, and by padding and bandaging joints. Be careful not to put too much air in the rings, that is, not enough to make them hard and unyielding—this causes pressure and may do more damage than the bed: There should be just enough to relieve pressure. When the patient is in danger of developing bedsores, an air or water mattress may be necessary to relieve all pressure. Water mattresses are seldom used because difficult to manage. When used the temperature of the water should be 100° F. An air mattress is cool. It supports the weight and relieves pressure as it yields to the body. When used it is usually placed upon another mattress and the air forced into it. Care must be taken not to fill with too much air as this in itself causes pressure sufficient to cause bedsores. It also gives a sensation of rolling and bouncing with every move so that there is danger of the patient rolling out of bed. Always watch him very closely. If he is very restless or unconscious put sides on the bed to avoid all danger.

Scrupulous care must be taken of both a water and an air mattress, as they are both very expensive. Be particularly careful in the use of pins to avoid injury as the slightest pin prick will render them useless. After use they should be disinfected and put away with a small amount of air left in.

3. **By Preventing and Relieving Discomfort from Friction, Rubbing or Chafing.**—The constant irritation from friction of the elbows, knees, ankles, or back of the head, on the bed or bedding, and the chafing of two surfaces of skin constantly rubbing together, may soon cause the skin to break down, forming bedsores. These parts should be protected by cotton rings held in place by bandaging, or pads bandaged in place, or by the use of cradles, to keep the clothes from rubbing on the part. The feet particularly should be protected, for when the patient is long in bed the circulation is poor (shown by the frequent tendency to cold feet) and therefore the tissues more easily break down, and heal very slowly. Where there is chafing from the surface of skin rubbing together the parts should be kept perfectly dry. The circulation should be improved by massage; irritation should be relieved by soothing ointments, and the parts should be separated by the use of pads or dressings.

4. **By Preventing and Relieving Discomfort from Extremes of Temperature,** either of the atmosphere, or from the bedding (too much or too little), or from an increased body temperature. See that the patient has sufficient, but not too much bedclothing. Turn and shake the pillows frequently. Pull the drawsheet through to give a cool place to lie on. Fan the upper clothing and raise the clothing by the use of cradles. Apply cold compresses to the head; sponge with alcohol; give cooling drinks. Where the patient is hot and feverish remove the soft pillow and allow him to lie on the cool hard pillow.

5. **By Preventing and Relieving Discomfort from Lack of Cleanliness,** or from crumbs, wrinkles or moisture in the bed.

6. **By Preventing and Relieving Discomfort from Interference with Bodily Functions and Annoying Symptoms**—nausea, vomiting, diarrhea, constipation, retention of urine, involuntary movements from lack of control of the rectum or bladder.

7. **By Preventing and Relieving Bedsores.**—Failure to observe the above measures may result in the formation of bedsores. They cause such great discomfort and form such serious lesions that they require special mention.

The prevention of bedsores is entirely the responsibility of the nurse, so that at the very beginning of her training, long before being entrusted with a patient, a nurse should learn how to care for a patient so as to avoid them. Bedsores are rarely unpreventable and are usually due to carelessness. The neglect and ignorance of one nurse may, in a few hours, undo the most skilled and devoted care of another. An "ounce of prevention is worth a pound of cure." Even a mild bedsore once developed is hard to cure and requires much more diligence, time, thought, and worry than prevention.

Since the advent of the trained nurse, bedsores are almost obsolete. A nurse in training may have little experience in the care of bedsores, so thoroughly are the rules of prevention observed. Patients who have been ill at home for some time.

however, frequently come to the hospital with bedsores, resulting from lack of knowledge or skill, even when they may have received the most devoted attention of relatives or friends.

Nature and Causes of Bedsores.—Bedsores or pressure sores result from an *interference in the circulation* in a part due to pressure: The pressure may result from the weight of the body lying too long in one position, or from splints, casts, bandages, or bedclothes. It is frequently aggravated by heat, moisture, lack of cleanliness, decomposing and irritating substances on the skin such as perspiration, urine, feces or a vaginal discharge. Wrinkles in the undersheet, crumbs, friction from restlessness, rubbing of the bedclothes or of two surfaces of the skin in contact, together with heat and moisture, as in a pendulous abdomen, all predispose to bedsores.

Anything which interferes with the circulation or nutrition of a part, especially if the nerve supply is deficient (as in a broken back, and in some fracture cases, and after operations when nerves have been removed) is likely to result in a pressure sore.

Those most in danger of developing bedsores and who, therefore, require special care are:

1. Patients with poor circulation from old age, lack of exercise in a prolonged illness, certain forms of heart disease, nephritis with poor circulation and edema.
2. Patients with anemia in which the quality of the blood and the nutrition of the tissues are poor.
3. Patients with a malignant growth such as cancer—cancer destroys as it goes, and the poisons absorbed from the dead tissue cause anemia.
4. Patients suffering from a prolonged infectious disease, such as typhoid, pneumonia, or tuberculosis. These patients are poorly nourished, their vitality is low and the high fever and the bacterial toxins absorbed cause an increased destruction of the tissues.
5. Patients suffering from paralysis—the part rests like a dead weight, the nerve supply is deficient and the lack of exercise makes the circulation, and therefore the nutrition, poor.
6. Very thin, emaciated patients with prominent bones.
7. Patients with no control of the bladder or rectum with an involuntary passage of urine or feces.
8. Those with a thin, tender, dry skin easily chafed.
9. Those with excessive obesity due to the weight of pendulous parts and to faulty metabolism and nutrition of the tissues.
10. In patients suffering from diseases of metabolism, such as diabetes.

The **Danger Points** on the body are the bony prominences (where there is no rich supply of blood to nourish, and over which there is only a thin layer of skin)—the coccyx, hips, elbows, heels, shoulder blades, knees, elbows, the inner malleoli (inner surfaces of the ankles), and the back of the head in infants. Between folds of flesh—under the breasts, or the abdomen, etc.—may become sore due to the heat, moisture, and chafing.

Why Bedsores Are Dangerous and Must Be Prevented.—They are a source of great discomfort to the patient. They are the result of actual destruction of the tissue producing lesions which are a serious drain on the patient's strength in the effort to battle against the injury and to repair it. They are very easily infected and the patient may die from the absorption of poisonous substances, or the kidneys and other organs of elimination may break down from overwork in the effort to eliminate the toxins.

The Symptoms of a Bedsore.—Nature's danger signals.—The first symptoms are *heat, redness, tenderness, discomfort,* and *smarting.* (When the skin is broken a bedsore has formed.) The heat and redness show that Nature has come to the rescue by circulating an increased amount of fresh arterial blood laden with food and oxygen to nourish and revive the injured tissue, and white blood cells to act as soldiers in preventing further injury, and as scavengers in carrying away the dead or damaged cells. The tissue is damaged and congested, but is still healthy and the chances of recovery are good if immediate and constant care and attention are given and the patient's condition is favorable—if neglected, a bedsore will surely result.

If the pressure is not relieved the circulation is greatly interfered with, the tissues become more congested, and the circulation in the part is finally shut off. The superficial veins first feel the pressure so that the outflow of blood is shut off and the vessels become engorged with venous blood which mechanically prevents an inflow of arterial blood. The continued pressure finally cuts off the supply of arterial blood. This congestion of the tissues with venous blood makes the part blue, purple or mottled, like a bruise, also cold and without sensation. If the pressure is not immediately relieved and the circulation restored, the tissues will surely die and a true pressure sore will result. Dead tissue cannot be restored to life, but remains as a slough (dead flesh in living flesh) which must either be absorbed and carried away by the blood or removed externally before healing can take place. Ferments or enzymes liberated from the dead and dying cells gradually decompose or soften it so that it may more easily slough away (to slough means to separate the dead from living tissue), or be absorbed by the blood and later eliminated by the kidneys. When the slough is removed an open raw surface or ulcer remains. This decomposition and sloughing can be aided by the application of hot compresses but one should never attempt to pull the slough away on account of the danger of hemorrhage from the relaxed congested blood vessels. During the normal sloughing process the blood vessels in the dead tissue gradually shrink and the ends in the healthy surrounding tissue close or anastomose with other vessels so that hemorrhage is prevented and the circulation is readjusted.

Preventive Measures.—Remove all the possible sources of danger. Remove all pressure by the use of air-rings for the end of the spine (avoid inflating with too much air and making too hard), cotton rings (for the heels, elbows, or back of the head), pillows, pads, or an air mattress. Remove pressure on an extremity by suspending and supporting it: Turn the patient frequently—the position may have to be changed every hour. Avoid the careless use of the bedpan such as using a chipped pan or by leaving the patient on it too long; cover the pan with a pad when there is danger of a bedsore. Keep the patient absolutely clean and dry; change a damp gown or bed linen immediately: When the patient has involuntary passages of feces or urine protect the bed with a large oakum pad which absorbs readily, and is easily changed, and saves the laundry. When a patient has a vaginal discharge watch the back carefully as the discharge is apt to run up the back under the dressing or pad and excoriate the skin. Absolute cleanliness is necessary. Wash with boric acid to remove decomposing urine and other discharges and oil the surface to prevent the urine, etc., from coming in contact with and irritating the skin. Rub the part and the surrounding tissue frequently with alcohol—at least morning and evening, or three times a day, or every four, every two, or every hour as the case demands. The alcohol cools, refreshes, hardens, drys the skin, and prevents chafing, and the rubbing stimulates and restores the circulation. When the skin is broken, rub around the part only. Rub with a circular motion away from the part so as to stimulate the outflow of the stagnant venous blood which will mechanically be replaced by the inflow of arterial blood. The circulation may also be stimulated by the application of hot water. Keep the skin dry by the use of powder after rubbing with alcohol. See that the patient's gown, the bed linen, and the coverings on air-rings or cotton rings are clean, dry, cool, and free from wrinkles or crumbs. Pad the elbows and knees or other parts exposed to friction. Where there is a tendency for the skin to chafe, rub with olive oil or cocoa butter. Keep surfaces of skin or folds of skin apart and apply an antiseptic powder to keep the parts dry.

The Treatment of Bedsores.—Report the first symptoms of a bedsore to the headnurse so that proper steps may be taken to prevent further damage. The treatment of a bedsore must be prescribed and the dressing performed by the doctor. It must be kept surgically clean like any other wound (by the use of antiseptics and the application of sterile dressings), and every aseptic precaution taken to guard against infection. If infection occurs there will be a discharge on the dressing. The ulcer will grow wider and deeper with a greyish unhealthy-looking surface and the surrounding tissue will look red and angry with signs of breaking down.

The treatment prescribed depends upon the condition of the wound and the rate at which healing or repair takes place. If there is no discharge and the surrounding tissue and the surface of the ulcer look healthy, the only treatment may be to keep it dry and surgically clean by the application of an antiseptic powder and a sterile dressing. A paste made of castor oil and bismuth, which is protective and drying, may be used. Stearate of zinc or boric acid powder are antiseptic, healing, and stimulating. When the healing is very slow and the sore is a long time in closing, repair may be stimulated by the application of Balsam of Peru or Scarlet Red ointment. Ichthyol ointment increases the resistance of the tissues, promotes the absorption of inflammatory products, and stimulates the healing process. It is also soothing to painful areas. Zinc oxide ointment makes a soothing protective dressing. It is insoluble in water and therefore protects the skin from moisture such as urine or excessive perspiration. Exposure of the wound to electric light rays both dries and stimulates, and is very effective in healing. When infection has occurred the ulcer may be cleansed by the use of antiseptics such as peroxid of hydrogen or Dakin's solution, and provision made for free drainage by packing with sterile gauze.

CHAPTER VIII

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY PERSONAL CLEANLINESS

The Morning Toilet

The Beginning of a New Day for Patients and Nurses.—The nurse arrives freshened by a good night's rest, ready for the day's work. The patients also begin a new day with varying feelings toward what the day has in store for them. Some will have had a good night's rest while others are exhausted by a long night of wakefulness and pain: Some are very low, not expected to see the light of another day: Some look forward with hope to another day nearer to recovery, to interest in the varied scenes and activities around them, while others are bored by the monotony—each day for them is much like the previous day: Others look forward with dread of what the day has in store for them—an operation, painful treatment or examination, or a long day of suffering, while some may be too sick to be conscious or care: Some are going home restored to health, while others have no hope of ever going home or being well again. To a new patient everything will be new and strange, and he will be interested in everything as it may relate to him. His first impressions on the beginning of this first day are very important and are indelibly impressed on his mind. A nurse should be quick to understand and feel the needs of each of her patients. This understanding depends upon sympathy—the power to feel with others and to feel as others feel. She should minister first to the patient who needs her attention most.

The ward in the morning should be bright, well ventilated, quiet and in order. The nurses should be cheerful, bright, brisk, fresh and clean, and should begin their work with a will. Each should have her assigned duties so that the work will proceed quickly, smoothly, systematically, and without confusion.

The day begins with meeting the needs of the patient as the first consideration. This will include taking and charting his temperature, pulse, and respiration, his morning toilet, making his bed, breakfast, treatments, and the care of his surroundings, making them hygienic, attractive, and orderly. The patient should be prepared and, as far as possible, all should be in readiness at nine or ten o'clock to insure the patient's comfort and facilitate his examination during the doctor's rounds.

THE BED-BATH

The morning toilet consists of the bath, care of the mouth, teeth, and hair, the use of fresh linen, making the patient's bed, and providing mental and physical comfort. The bath may be a full bed-bath or a partial bath.

The Value and Purpose of the Bath in Disease.—Sick people are often weak, tired, exhausted, uncomfortable, hot and feverish. In patients who are suffering from a prolonged illness, the circulation in the skin, and its nutrition may be so poor that it cannot perform its proper functions, and may break down, with the formation of bedsores. Again, in the different diseases from which they may be suffering, the functions of various organs may be impaired and this may interfere with, or increase the work of the skin. For instance, in diseases of the heart, the circulation in the skin may be so poor that there is not enough heat to vaporize the perspiration so that the patient is covered with a cold, clammy sweat which is most uncomfortable. It also predisposes to chilling, colds and pneumonia.

In other diseases, the work of the skin may be greatly increased. For instance, when the kidneys are diseased and fail to eliminate waste products as they should, extra work is thrown upon the skin. Sometimes a layer of urea (the chief waste product in urine) is formed on the skin and is spoken of as "urea frost." Other abnormalities, often very irritating to the skin if allowed to remain, are excreted in the perspiration during the course of various diseases. For instance, in fevers, increased lactic acid is eliminated and in rheumatism, increased uric acid, giving the perspiration (which is often profuse) a very sour odor. Acids are always irritating to the skin. Again, in the excessive perspiration from the feet, it frequently contains leusin, tyrosin, or ammonia which, when decomposed, have a very disagreeable odor and are very irritating.

The purpose of the bath is, therefore:

1. To refresh the patient and relieve discomfort from position, heat, moisture and other causes. The beneficial effect of the water is aided by the use of massage, which stimulates the circulation, and by the use of alcohol which cools, dries, hardens, and refreshes the skin.

2. To cleanse from—(1) external dirt (dust and infectious material); (2) internal dirt (excretions from the body, the wastes of metabolism); (3) decomposing substances which are irritating and give rise to disagreeable odors.

Number of Baths Desirable.—Very sick patients should have a full bath daily. A daily bath is always desirable, but in the public wards of a hospital the amount of work and time involved make this impossible. Usually two complete baths are given weekly, a partial bath being given on other days.

The **best time for bathing** is before breakfast or before retiring. One hour after a meal should elapse before bathing, in order not to interfere with the processes of digestion. There is only a certain volume of blood circulating in the blood vessels of the body. During digestion an increased amount of blood is required in the vessels of the stomach and intestines. Bathing and rubbing the skin causes an increased amount of blood to flow through the vessels in the skin and thus robs the vessels in the stomach, intestines, and other organs.

The Beneficial Effect of the Morning Bath.—Any doubts that one may have as to the beneficial effect of the morning bath are dispelled by observing its effect on a sick patient. The patient's chart, her exhausted appearance and condition, her pulse weak and irregular, may indicate a very restless, sleepless night and a condition very low, approaching death. After a warm bath, massage, change of linen, and remaking of the bed, if skilfully done, the patient will usually doze off into a peaceful, sound, restful slumber, from which she will waken refreshed with all her vital powers refreshed and restored: Her pulse, breathing, and whole appearance and condition will show improvement.

When the doctor arrives he does not see the patient at her worst, does not see all the symptoms which really indicate her condition. This emphasizes the importance of close, accurate observation and recording, and the necessity for the doctor seeing the patient sometimes before the morning toilet. Sleep is a great blessing, merciful to all.

Preparation for the Bath.—Before beginning the bath see that the room is warm (70 to 75°), that the windows are closed, that the patient is protected from drafts, and that everything necessary for the bath is at hand.

Method of Procedure.—The technique will vary in different hospitals, but the underlying principles will be the same in all. The articles used will vary somewhat according to the technique, but will include a large basin of water at 100 to 105°, a warm bath towel and face towel, wash cloths, soap, alcohol and nail brush, comb and brush, talcum powder, articles for cleansing the mouth, protection for the bed and protection for the patient for cover and warmth.

During the procedure only the necessary exposure should be permitted (no exposure is really necessary) both to guard the patient's feelings and to prevent chilling. The patient is covered with a bath blanket and all the upper bedclothes are removed or turned to the foot of the bed. One pillow only is left under the head unless this position is uncomfortable. Remove the gown. The patient may be allowed to cleanse her mouth and teeth and also to take her own bath, if her condition permits, but the nurse is responsible for seeing that it is thoroughly and properly done. Proceed in the following order: The face, ears, neck, chest, arms and hands, abdomen, back, thighs, legs, feet, and pubic region. Give special attention to the ears, between the fingers and toes, axilla, umbilicus and pubic region. Work quickly and wash with firm but gentle pressure. Dry each part separately and thoroughly. After drying the back rub with alcohol, to cool, refresh, and harden the skin, and with powder to refresh and dry. Give particular attention to parts that are red, to the end of the spine, and to all prominent parts. In washing the feet, place the tub on the bed (protected with a towel), place the feet in the tub, and if dirty, allow them to soak. Then scrub until thoroughy clean. While the feet are soaking, the finger nails may be cleansed and trimmed. Remove the feet from the tub and dry them thoroughly, drying well between the toes. Cleanse and trim the nails. The gown may be replaced after drying the back, or after the bath is completed.

The care of the hair is left until the gown and bedclothes are replaced and the patient is quite comfortable. The care of the hair is a somewhat lengthy process and the patient may become chilled if not properly covered. The upper bedding and pillow are protected with a towel and the hair brushed, combed and braided before shaking and replacing the pillows.

Work quickly, quietly, and smoothly when bathing the patient. Do not dawdle, allowing the water to get cold, and exhausting the patient. Make the patient feel that your mind is on the bath and not on other work waiting to be done. In washing the patient, do not allow the ends of the washcloth to dangle. They will feel cold and most uncomfortable; expose and finish one part at a time. Do not use more water than is necessary, or allow it to drip over the patient.

When the bath is completed, re-arrange the bedclothes and remove the bath blankets or towels, etc. Shake and replace the pillows. If the patient feels chilly place a hot water bag at the feet and give him a hot drink. Clear away the utensils, etc. See that they are clean and dry, and that the blankets are neatly folded and everything put in its proper place. See that the table, chair, and bed are in perfect order before removing the screen. When finished, inspect your work—is your patient comfortable and does your work measure up to the standards and ideals you have set?

When a full bath is not given a partial bath—cleansing the mouth, face, hands and arms, back and pubic regions—is given. In some cases the morning toilet (when a full bath is not given) consists in washing the face and hands, cleansing the mouth, rubbing the back with alcohol and powder, combing, brushing, and braiding the hair, changing the soiled linen and remaking the bed. The most scrupulous care should be given to the mouth and back. Every means of making the patient comfortable should be attended to.

When the bed-bath is being given to a patient on admission, it is frequently necessary to use a large amount of soap and water so that extra protection is required for the bed. A large rubber is used. Benzene, ammonia, tincture of green soap, and a brush will be necessary if the feet are very dirty. Otherwise the method of giving the bath is the same.

The Care of the Mouth and Teeth

Mouth hygiene, the sanitary mouth, or the care of the mouth and teeth is said to have ushered in a new era in preventive medicine. It is one of the main points of attack in preventing or curing disease, and in the preservation of health.

Importance of the Care of the Mouth.—As we have learned in the study of bacteriology, the mouth is an ideal incubator for germs as it contains food, air, moisture, and warmth. Even in healthy mouths bacteria are probably always present while in neglected mouths they are abundant and multiply rapidly. As a result of experiments, 100 varieties of lactic acid producing bacteria have been found in a neglected mouth and 50 varieties in a decayed tooth. These bacteria break up the carbohydrates, causing fermentation with the formation of acids.

The Effect of Acids on the Teeth.—Acids destroy the enamel and the pulp of the teeth and allow the invasion of bacteria, which causes abscesses at the roots of the teeth and pyorrhea alveolaris. Devitalized teeth are very prone to infection at the roots. The presence of bridgework and plates, etc., makes the mouth difficult to keep sanitary and gives rise to infection.

The Effect of a Neglected Mouth on Digestion.—A neglected mouth spoils the appetite and decayed teeth interfere with mastication. The pus from abscesses and the acids and bacteria swallowed interfere with digestion. The bacteria cause fermentation in the stomach and intestines with the formation of gases (tympanites). Infection in the mouth may spread to and interfere with the function of the salivary glands.

The Effect of a Neglected Mouth on Other Parts of the Body and the General Health.—Infection may spread to the sinuses, to the eyes, up the Eustachian tubes, to the ears, to the tonsils, to the salivary glands, and the cervical glands. From diseased tonsils, rheumatism, endocarditis, and chorea may develop. Infection and abscesses at the roots of teeth are associated with arthritis, nephritis, gastric ulcer, appendicitis, endocarditis and other serious diseases. From a neglected mouth in typhoid a patient may reinfect himself. A neglected mouth is a menace to the entire system.

The kind of patients apt to develop bad mouths, who therefore require special care, are:—(1) Unconscious or dying patients; (2) patients suffering from fevers, such as typhoid and pneumonia, in which the lips, tongue, and membranes of the mouth become dry and cracked. Food, milk, dried epithelial tissue and bacteria get into the cracks forming thick tenacious deposits called sordes, very difficult to remove. If not kept clean, very painful ulcers on the tongue and cheek, tympanites, and infection of the ears or glands results; (3) in many diseases, in almost all forms of illness, and in all very ill patients, especially those on liquid diet, the tongue becomes furred.

General Care of the Mouth.—It should be kept clean and moist, and cleansed with an antiseptic solution frequently. Mouth breathing, and any mechanical, or chemical injury to the gums with tooth brushes, pastes, or medicines must be avoided.

The Daily Routine Care.—The mouths of convalescent patients should be cleansed three times a day, or at least in the morning and evening. Very ill patients, patients with a high fever, or those with difficult breathing who breathe through the mouth, should have their lips and mouth cleansed more frequently: They should be cleansed before fluids, and the mouth should be well rinsed after fluids. The tongue should not be cleansed directly after fluids, as it may induce gagging. Special care should be taken in rinsing and cleansing the mouth after milk. The patient should be given water to drink freely, in order to supply the tissues with fluid and keep the mucous membrane of the mouth moist and clean. For all sick patients moisten the lips and tongue frequently.

Mouth Washes Commonly Used.—For *general purposes* the following solutions are satisfactory:—Listerine and water, equal parts: Glycothymolin, one-third strength: Boric acid solution: Dobell's solution, one part in three parts of water or Dobell's solution and listerine, equal parts: Lemon juice and glycerin, equal parts or one dram of lemon juice in three drams of glycerin.

For a very *dry mouth* the following are effective:—Albolene and boric acid, equal parts with a small amount of lemon juice: Listerine, peroxid of hydrogen and lemon juice, equal parts, diluted to one-half strength with water: Glycerin, drams two, lemon juice, drams two, boric acid, ounces two, and water ounces two.

When the *mouth is dry and the tongue is very coated and dirty*, the application of cold cream or liquid albolene ten or fifteen minutes before cleansing will soften and greatly aid in cleansing.

When *sordes have formed* and the mouth is in a bad condition, the following mouth washes are effective:—Dilute hydrochloric acid, minims fifteen, essence of peppermint, dram one, dilute one-half strength with water: Tincture of myrrh, one part with eleven parts water, or tincture of myrrh, potassium chlorate, Dobell's solution, each drams two, and water, ounces four. Glycerin alone is healing but should not be used when the mouth is dry, as it is too astringent.

When possible, always use a mouth wash which is pleasant to the taste and agreeable to the patient. Always rinse the mouth well after using an antiseptic mouth wash. Allow the patient to cleanse his own mouth when his condition will permit. Use his own tooth brush when available. A nurse, before cleansing the patient's mouth, should see that her hands are scrupulously clean.

To *cleanse the mouth of a very sick patient,* remove one pillow and turn the patient's head toward you. Protect the patient and the bed by placing a towel under the chin across the chest. Open the mouth and examine it before and during the procedure. Cleanse all parts thoroughly but use the greatest caution not to break or injure the mucous membrane, as this makes it more liable to infection. Cleanse with the solution or paste on the patient's tooth brush or on gauze wrapped carefully around a tongue depressor or whalebone; use each piece of gauze only once. Avoid making the patient gag; avoid touching the back of the throat. Use a swab (cotton on a tooth pick) for removing particles between the teeth. Allow the patient (if strong enough) to rinse his mouth after cleansing, first with an antiseptic mouth wash, then with water. When the tongue is parched and dry, apply liquid albolene to the tongue with a medicine dropper after cleansing.

Brushing, Combing and Braiding the Hair

The hair should be attended to morning and evening, if possible. Special care should be taken for a very sick patient or during a long illness.

The object in the care of the hair is (1) to add to the comfort of the patient; (2) to keep it clean and tidy; (3) to preserve it and keep it free from tangling, etc.

In combing or brushing the hair, comb small strands at a time. To prevent pulling and further tangling, hold the strand above the part being combed so that the pull comes on your hand, not on the hair roots, and comb the tangles out from the ends first. Comb gently, but remove all tangles. If the hair, through neglect, carelessness or want of skill, has become snarled or tangled, it may be difficult or impossible to disentangle it without torturing the patient, and causing injury to the hair. The tangled portion may have to be cut out. Applying vaseline or sweet oil, or wetting the hair with alcohol will help to remove the tangle, but time, patience, and skill are required. This disgraceful condition will never occur (except possibly after some accidents or operations on the head) if the hair is attended to properly each day.

Braid the patient's hair in the way most comfortable to the patient. When she is lying down it is best to part the hair from the brow to the middle of the neck and braid it in two braids, one on each side, so that the head of the patient will not rest upon it.

The Art of Making the Patient's Bed

In making a bed with a patient in it, observe the following principles: Screen the patient and allow no unnecessary exposure or drafts. Have everything at hand before beginning. Study the patient's condition and have everything necessary for his care and comfort that his condition may demand. Remove all the upper clothing except one blanket—a patient should never be left without a blanket except in hot weather. Fold the spread and place all the clothing on one or two chairs to air; do not allow them to touch the floor. Remove the pillows also unless this is uncomfortable for the patient. One pillow may be left. The removal of the pillows provides a change of position, which is usually restful to the patient: It allows the pillows to cool, and makes it easier for the patient to turn and for the nurse to work. Loosen the lower bedlinen. Shake out all crumbs from the patient's gown, or change it if damp or soiled. Remove the rubber and draw-sheet and allow them to air. The rubber is hot and becomes uncomfortable, while both are apt to become wrinkled and disordered. Brush all crumbs from the lower sheet or change if necessary. Move the patient from one side of the bed to the other as the occasion demands, but never disturb a sick patient more than necessary, and in every possible way conserve his energy. Straighten the mattress and tighten the under sheet. Replace the rubber and drawsheet and see that they are tight and smooth and in the proper position. Shake, turn, and replace the pillows and the upper bedclothes. Before removing the screen make sure that your patient is comfortable. Remove all the articles used in the toilet and see that the bed, table, and chair, etc., are in perfect order, and that your work has a finished appearance.

Washing the Hair

When an illness is prolonged and the patient has been confined to a bed for a long time, the condition of the scalp and hair becomes a source of irritation and discomfort. It then becomes necessary to wash the hair with the patient in bed, for cleanliness, for comfort, and to preserve the hair. The shampoo may be given with little or no inconvenience to the patient.

Method of Procedure.—See that everything required for the procedure is at hand before beginning. Place the patient at the side of the bed in a comfortable and convenient position. Leave the hard pillow only under the head, and place it so that the patient's cheek will rest against it when the head is turned on one side during the treatment. Arrange the patient's gown and the upper bedding so that they will not be in danger of getting wet. Protect the pillow and under portion of the bed with a large rubber, arranging it in the form of a trough so that the water will flow into the receptacle on the floor, and not down the patient's neck, or be absorbed by the clothing. Place a rubber dressing sheet across the upper bedclothes and the patient's chest and fasten it securely around the neck. A towel may be placed between the rubber and the patient's skin. A folded towel may be placed under the cheek to protect it from the rubber. The towels must not be exposed, however, as they will absorb the water and wet the patient and bedding. Non-absorbent cotton may be placed in the ears. The patient should keep her eyes closed during the treatment.

In washing the hair use plenty of soap and hot water, and massage the scalp well. Rinse thoroughly, first with hot, then with cool water and dry as quickly and thoroughly as possible with hot towels, and by rubbing and fanning. Remove the wet things and make the patient comfortable as quickly as possible in order to protect from exhaustion and from getting cold. A small rubber and towel may be placed on the pillow. The hair may be spread on this and the fanning and rubbing continued until it is quite dry. The hair should not be braided until quite dry.

The Bathing of Infants and Young Children

The bathing of infants will always be assigned to an experienced nurse, because they are so delicate, so sensitive to cold and exposure and so susceptible to infection. They require considerable skill in handling, lifting and supporting, in undressing, weighing, bathing and dressing quickly and without unnecessary exposure. Their delicate skin and the mucous membranes of the mouth, nose and eyes are so easily irritated and injured in cleansing that they require the most expert care. The importance of the observation of symptoms and the length of time, special training and experience required before one can understand little babies and observe the symptoms of disease are other important reasons for assigning the bathing of infants only to an older and more experienced nurse.

Probationers may, however, be required to bathe older children. The bed bath will be much the same as for an adult, giving particular attention to the mouth, buttocks and genitals. Children should be taught very early to clean their teeth properly. The head should be examined carefully for pediculi. The room should be warm; the bath should be given quickly, and the child must not be exposed or chilled during or after the bath.

When a tub bath is given, a child should never be left alone. The temperature of the water should be 85° F., the bath should last only a few minutes and should be followed by a cold douche at 70° F., the child standing in the tub. This should be followed with a brisk rubbing until thoroughly dry and warm.

Daily baths should be given to all children while in the hospital, if possible. They not only promote the child's health, but teach him proper standards and habits of cleanliness which go far toward building up a strong, healthy body. One of the chief duties of the nurse and of the hospital is to teach proper habits of living. Children are very impressionable. Their habits are still to be formed, and they are quick to observe and eager to imitate the habits and standards of those about them. They unconsciously imitate those about them. We cannot prevent them from forming habits, either good or bad, but it is our duty to see that they form only good habits.

CHAPTER IX

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY PROPER FEEDING

The Effect of Food in the Care, Comfort, and Recovery of the Patient.—"The maintenance of vital resistance by proper feeding" is one of the first of the influential factors in the treatment of all forms of disease, "often of greater importance than the measures devoted to the treatment of the disease itself." The human body has been compared to a lifeless machine in that both wear out; both need repair; both do work, and both need fuel. In the human body the material for growth and repair, the power to do work and supply heat, can only be supplied by food—food is absolutely essential to the maintenance of life.

The Kind of Food Required

1. For growth and repair—*protein,* which forms one of the chief constituents of meats, eggs, milk and milk preparations such as junket and custard, etc., used in the body to build new tissues and to repair damaged or partly broken down cells. Protein comes from a Greek verb meaning "to take the first place" and is called so because it is absolutely essential to the formation of protoplasm, which is the basis of all living things. Protein may also be oxidized as fuel in the body as a source of energy for muscular work because these nitrogenous organic compounds contain, in addition to *nitrogenous* derivatives, *non-nitrogenous* elements from which glucose and glycogen (and indirectly, fat) may be formed.

Gelatin is a simple but incomplete protein; that is, it does not contain all the essential amino acids necessary to maintain life or to support growth. It is, however, a very useful protein in the diet. When added to broths and desserts these serve to supply protein and act as protein sparers by preventing the breaking down of body tissues.

2. For the power to do work and to supply heat—*carbohydrates* and *fats* are both used in the body to create heat and energy, just as fuel is used in an engine. Carbohydrates are given in the form of cereals, vegetables, fruits, bread, drinks containing sugar, broth containing barley, etc. Fats are given in the form of milk, cream, butter and oils, etc. Both may be

stored up in the body as reserve fuel capable of being burned up or converted into the heat and energy necessary to maintain life. *Heat* is necessary to maintain the body temperature at which life or the chemical processes which mean life can be conducted, just as we must have heat to produce the chemical changes in meat and other foods which give them their agreeable flavors. *Energy* is necessary to carry on the life activities or functions which distinguish the living from the dead. Remember that energy is required, therefore fuel must be burned, every time we breathe, or the heart beats, or the eyelids open or close, or a hand is raised, so that if fuel (carbohydrate or fat) is not supplied these functions cannot go on.

The body simply must have both heat and energy, even at the expense of its own tissues. Protein should be reserved in the body for growth and repair, but if carbohydrate and fat are not supplied or, because of some disorder in the body, cannot be used then the body uses protein as a substitute. This may be the protein given in the food which should be used for growth and repair, or it may be the protein in our own tissue cells; that is, the body gives up its own tissue so that we are gradually consumed as fuel in order to create the heat and energy necessary to breathe and make the heart pump the blood around, etc.—Self-preservation is the first law of nature.

Now which fuel should we give to the sick—carbohydrate or fat? Always that which is most easily digested and assimilated should be given because the patient's vital powers are low and digestion itself uses up energy. Fats are not easily digested by sick people because they are difficult and require a great deal of energy to burn. Burning or combustion is the chemical process of oxidation, that is, adding sufficient oxygen to break up the compound. Fuels, carbohydrates and fats, both contain a certain amount of carbon, hydrogen, and oxygen. The ease with which they are burned and the amount of heat and energy given off depend upon the amount of carbon present and the amount of oxygen required, that is, upon the relative proportion of carbon and oxygen. Take, for instance, a simple sugar, glucose, the chemical formula of which is $C_6H_{12}O_6$—it is easily seen that little oxygen is needed, that is, it is easily burned. Compare a fat, the chemical formula of which may be $C_{57}H_{110}O_6$ and you will readily see that while the fat, when completely burned, will yield more heat and energy, it will burn more slowly and with more difficulty. Fats must therefore be given sparingly, and when given they must be finely divided.

Now if we do not give the patients the proper foods we allow them to starve before our eyes, or if we allow very sick patients to exert themselves unnecessarily we force them to use up energy which should be conserved for the vital processes of breathing and the work of the heart, etc.

Certain salts are also essential. Sodium chlorid (the common table salt) is needed chiefly in the fluids of the body to keep up a constant exchange between them and to maintain the same concentration or osmotic pressure. All animals are fond of and require salt. A porcupine, for instance, will gnaw through the thickest beam or floor of a house to obtain salt, and buffaloes will travel miles in droves to reach the "salt licks" for the sake of licking the salt.

Other salts and minerals, such as potassium, magnesium, and particularly calcium, phosphorus, iron and iodine, are equally essential for the normal development of the body and all its functions. They are necessary constituents of bone and of soft tissues such as muscles, glands, and blood cells; they maintain the osmotic pressure, the solvent power, the neutrality or slight alkalinity of internal fluids, the acidity or alkalinity of digestive juices and other secretions, and have a marked influence on the elasticity and irritability of muscles and nerves by their presence in the fluids in which these tissues are bathed. The right concentration of these inorganic salts in the body tissues and fluids is extremely important—any considerable departure from normal is incompatible with life.

Milk, vegetables, and *fruits* are rich in these essential inorganic salts, and also in vitamins, and therefore form important constituents in every diet. Milk is of special importance during the growing period.

Water is necessary for the chemical changes upon which life depends—it is the universal solvent, and substances must be in solution before the chemical changes can take place. Water is a necessary constituent of protoplasm (90 per cent. of protoplasm or 60 per cent. of the body is water); it stimulates the secretions, keeps the mouth moist and in good condition, relieves thirst, aids digestion and elimination, and has a very important influence upon metabolism.

It has been demonstrated scientifically, that an inadequate supply of water will give rise to symptoms of abnormal function such as headache, nervousness, inability to concentrate, loss of appetite and other digestive disturbances, all of which disappear on the restoration of an adequate supply of water to the tissues.

Unless fluids are restricted, the patient should be encouraged to drink plenty of water. The supply must not be left to chance or until the patient complains of thirst.

Vitamins, the nature of which is not yet entirely understood, are essential to the normal functions and development of the body, and to maintain its resistance to disease. Vitamins have been classified according to their solubility, and the symptoms and "deficiency diseases" which arise from lack of vitamins in the diet.

Fat-soluble A is sometimes called *antiophthalmic vitamin* because its lack causes an eye disease called ophthalmia or conjunctivitis. A *deficiency in the diet* results in loss of appetite and weight, weakening of the tissues, increased susceptibility to infections of the eye, ear, sinuses, glands, skin, lungs, and bladder, and interference with normal reproduction (ovulation). *To supply vitamin A,* the diet should contain such foods as milk, butter fat, eggs, green vegetables, bananas, liver, and fat beef. It is also contained in codliver oil.

Water-soluble B is sometimes called *antineuritic vitamin* because its lack causes a form of neuritis (beriberi). Vitamin B is also essential to growth and health. It stimulates the appetite, the digestive and metabolic processes which promote growth. A *deficiency in the diet* results in loss of appetite and weight, lack of vigor, indigestion, constipation, and malnutrition of the nervous system. *To supply vitamin B,* the diet should contain milk, fruits, vegetables, eggs, whole wheat bread and whole grain cereals. It is also contained in orange juice, tomato juice, and yeast.

Water-soluble C is sometimes called *antiscorbutic vitamin* because its lack will cause scurvy. Vitamin C is also essential to normal nutrition and health. A *deficiency in the diet* results in lack of energy, pains in the legs and joints (rheumatism), tooth defects and decay, and general increased susceptibility to infections. It is said that slow healing of wounds during the war was due to a lack of vitamin C and that the prevalence of defective teeth is at present due to this lack. *To supply vitamin C,* the diet should contain especially oranges, lemons, tomatoes, raw cabbage, and also such fruits and vegetables as apples, bananas, carrots, and potatoes.

Fat-soluble D is also called *antirachitic vitamin* because a deficiency causes rickets. Vitamin D plays an important part in mineral metabolism especially in regulating the normal deposit of calcium phosphate essential to the developing bone. It is thought that the beneficial effects of sunlight and the ultraviolet light in rickets is due to the fact that they form this necessary vitamin from the cholesterol always present in the skin. Vitamin D also improves the appetite, appearance, energy and general health. *It is provided* by a diet containing whole milk, egg yolk, fresh vegetables, and by the administration of codliver oil.

Fat-soluble E is also called *antisterility vitamin* because, in addition to other vitamins, it is required for the nutritional processes of reproduction (function of the placenta).

Effect of an Insufficient Supply, Faulty Digestion, or Assimilation of Food.—Anyone who has been very hungry will know the feeling of weakness and lack of energy, the constant nagging sensation of hunger with irritability and inability to pay attention, to concentrate, to study, or to do anything, in fact, even to take an interest in the things usually enjoyed. Again, when suffering from indigestion, how peevish, irritable, heavy and dull one feels. When indigestion becomes chronic the facial expression, the whole mental and moral outlook are changed. One develops the dyspeptic face and disposition, a pessimistic, gloomy, grouchy, ungenerous attitude toward life.

One is unable to take a large view, cannot sleep, and one's mind becomes concentrated on oneself, like a growth eating away at body and soul and mind.

There is a form of insanity due to starvation and hunger, and a body never properly nourished has a definite relation to crime. Starving people are not entirely responsible for their actions. They may be starving because they have not enough to eat, or because their tissues are unable to assimilate or use the food given them. Patients who are on a "special diet," that is, who are suffering from a disease which makes a restricted diet necessary, are always, and very naturally so, difficult to satisfy and they require special patience, tact, and sympathy. Diabetic patients, that is, patients whose tissues are unable to use the sugar supplied them, and so are never satisfied, are most pathetic. They have a constant, intolerable craving for food—so great that their morals may become so depraved that they will steal, lie, or do almost anything to obtain food, even though they know it means death. They cannot be trusted because their self-control, will, and all their inhibitions finally become broken down so that they are unable to resist the cravings of their tissues. Remember that nearly all forms of illness interfere with digestion, either directly or indirectly, from lack of exercise, poor circulation, or general depression.

The Effect of Fever.—The high temperature and the toxins cause increased destruction and wasting of the tissues so that the patient becomes very emaciated. The mouth becomes dry; the appetite and digestion are poor, so that very great care must be taken to keep the mouth in good condition, to stimulate the appetite, to supply food which will be easily digested, and which will nourish and build up the tissues and prevent them from wasting away. They require plenty of water also.

For the patients the meals are the chief events of the day, the chief events to look forward to so that if they enjoy their meals they are apt to be happy and contented with everything else, so great is the effect on both mind and body.

Conditions which Favor the Digestion and Assimilation of Food.—This means not only giving the patients food suitable in quantity and quality, but food which they will be in condition to digest, and not only to digest, but to absorb, distribute and utilize so that it may be converted into new tissue or into heat and energy. We are living in the midst of plenty, but many are poorly nourished.

The Condition of the Mind.—Freedom from the emotions of pain, excitement, worry, anxiety, fear, anger, passion, depression, monotony, irritability, nervousness, homesickness, or distress of any kind.—It is a well known fact, within the experience of all, that any painful emotion interferes with digestion. Each inhibits the secretions of the body, not only the saliva, gastric juice, intestinal and pancreatic juice necessary for digestion, but the secretion of other glands essential to the working of the body. These glands have been called the drug stores, the chemical reserves of the body, which secrete very powerful substances having a marked effect on every organ in the body. Painful or violent emotions may throw them completely out of gear.

Common Expressions Used Indicating the Effect of Painful Emotions.—"White with rage," "frothing at the mouth" with anger; "beads of perspiration," or "in a cold sweat" with fear; the "hair rising" with fear or anger; "don't get your back up" with anger; "the eyes popping out of the head" with excitement, trembling with excitement, fear or nervousness; "the tongue cleaves to the roof of the mouth"; the "heaving chest" with grief or anger; the act of blushing with anger, etc.; "my heart was in my mouth," and many expressions in literature ("Good digestion waits on appetite and health on both"—from Macbeth)—all show that the effect of these emotions on the functions of the body is a matter of common experience. Experiments on animals show that when they are in fear or anger there is no secretion of digestive juices and no contractions of the muscles of the stomach or intestines: All the abdominal viscera are out of commission, so that the food remains stagnant. The result with a person is usually a sick headache, followed by vomiting. The "ordeal of rice" was a test for crime used in India in which the suspected person was given rice to chew; if it was ejected dry, showing fear, the person was considered guilty.

Never give food immediately after excitement, passion, grief, or any of the above conditions. Repeated emotions will make the condition—stagnation of food—chronic.

Pleasurable sensations and emotions, however, aid digestion by increasing the secretions and contraction of muscles, and so we have such expressions as "laugh and grow fat," and "joy never kills." In the olden days the beneficial effect of pleasure and laughter on digestion was recognized in the custom of having a jester always present during dinner. Pleasurable companions, bright cheerful surroundings, interesting, witty conversation, laughter, a cheerful frame of mind, the sight, taste, and smell of appetizing food, food well and daintily served, a good appetite and pleasure in eating all favor digestion and assimilation. Eating too much or the sight of too much food will spoil the appetite. Unsavory food, unpleasant odors, lack of variety, being obliged to think, to plan or to decide what one will have, all interfere with digestion.

Freedom from Excessive Fatigue, Mental or Physical.—The products of fatigue circulate in the blood and have a very depressing effect on the nervous system, which inhibits the secretions of the body and the contraction of muscles, so that food in the stomach and intestines will remain stagnant. Experiments on animals show that these results may be obtained in an animal quite fresh and lively, by injecting into it blood drawn from a fatigued animal. This fatigue may be of the body or the mind from overwork, loss of sleep or rest, or fatigue of the senses due to din and noise, confusion, too much reading, talking or needlework, etc.

Freedom from hurry, with regularity and punctuality in serving.—Sick people should be allowed to eat their meals very leisurely. If hurried they become nervous and unable to eat. Also if hurried they are unable to masticate their food properly and so break the first rule of digestion, for digestion means to tear apart.

Rules to Be Observed in Feeding Patients

1. See that the patient is properly prepared. Have no unnecessary articles on the bed or table (except flowers). Arrange the pillows, etc., so that the patient will be in a comfortable position for eating. See that the table and tray are in a convenient position.

2. Remove as far as possible disturbing sights likely to disagree with the enjoyment of the food; place a screen around the bed of a patient who is vomiting or who is very ill or dying.

3. Do not serve food directly after a painful dressing or excitement. See that all patients are allowed to use the bedpan before, but never during meals unless absolutely necessary.

4. The ward should be quiet and in order during meals and the patients undisturbed by treatments, dressings, visitors, or doctors' rounds.

5. The patients should be alone and unobserved as much as possible. When eating they should not be obliged to talk or be talked to, especially about food. Their minds should not be kept busy or distracted by anything demanding attention.

6. Their appetites should not be spoiled by hearing food talked about, by seeing or smelling the food of others, by seeing it in the raw state or in bulk when brought in by visitors, or by having more than they can consume. The very thought of food often makes a patient ill.

7. Don't discuss food with the patient. This robs it of the element of surprise and novelty. Don't ask the patient to decide what he will have. This is often an effort, even to well people who enjoy it more if someone else decides for them.

8. Be very strict in giving food according to the doctor's orders, which are based on the patient's condition. The diet is an important part of the treatment and the patient's recovery may depend upon it. It may be a *"special diet"* in which the amount of protein, carbohydrate, and fat is prescribed, carefully weighed out, and prepared, and the amount taken by the patient estimated and charted. It may be a diet in which certain foods are entirely prohibited: It may be a *"salt-free"* diet, that is, the patient is allowed nothing containing salt. It may be *"starvation diet"* in which the patient is allowed nothing at all for a certain length of time. It may be a *"milk diet"*—nothing but milk. It may be *"full"* or *"regular diet"*—anything the patient desires. It may be *"light diet"*—the amount and kinds of meat

restricted. It may be *"soft diet"*—foods very easily digested with fluids in addition. It may be *"fluid diet"* only—the fluids being given every two hours amounting to from four to six pints per day, and containing the prescribed number of calories which varies with the condition—the normal average man requires 2300 calories when at rest in bed to meet the daily needs of the body. The *fluids may be forced* as in toxic conditions, rheumatism, gout, after a hemorrhage, and in deficient elimination by the kidneys and other diseases; or the *fluids may be restricted*, as in ascites, dropsy, edema or effusions. Certain tests also may be performed for diagnosis or treatment, in which regulation of the diet is necessary.

A nurse must never give anything to the patient, either to drink or eat, without being fully acquainted with the diet that the patient is permitted to have.

9. See that the food is properly cooked and served; that it is not burned or greasy, and that the tray is daintily arranged.

10. Consider the individual needs and preferences of each patient based on religious, racial or family food habits, likes and dislikes regarding food and seasoning. Examples are: tea with or without sugar or cream, milk with ice, milk warmed, no tea, no coffee, likes cocoa or postum, no fish, no pork, no sugar on cereal, eggs soft cooked, soft foods easily masticated, and such extras as anticonstipation and high caloric foods.

One of the simplest ways of insuring accuracy and providing for individual preferences, is to use printed cards of different colors representing types of diet such as regular, soft, liquid, and "special," on which the student responsible for the patient adds his individual preferences, the whole being checked by the head-nurse and placed in the file in the serving room. No tray is then served without a card. "Special diets" are copied as ordered by the doctor. Only suggestions relating to the serving of food and whether tea or coffee (when permitted) is desired, are written on these cards. The patient's preferences are written on the diet sheet returned to the dietitian.

11. See that the tray is complete, not minus fork, knife, spoon, or seasoning—salt and pepper. Flavors and seasoning have little nutrition but they are pleasant to the taste and therefore aid digestion.

12. Select food according to the patient's appetite: Give small servings and one thing at a time to tempt the appetite.

13. Use diplomacy, not force, in feeding; coax, encourage, entice, tempt the patient.

14. Do not drop or spill things in transit, such as tea in the saucer.

15. Serve meals promptly, especially fluids. The stomach empties itself and demands food regularly. This is illustrated by babies, who invariably cry (if healthy) when it is near feeding time. Adults do not cry but nevertheless their stomach and tissues demand food just as insistently.

16. Do not hurry the patient. Give assistance (such as cutting meat) when required.

17. Serve hot food on hot dishes—see that the steam table is hot; serve cold food on cold dishes.

18. See that the dishes are clean and whole.

19. Avoid extremes of temperature, rich or highly seasoned foods in gastric disturbances.

20. Be sure that food such as meat, milk or eggs, etc., is always in perfect condition and properly prepared.

21. Never leave food untasted or partly eaten on the stand. The sight, odor, or thought is nauseating to the patient, ruins his appetite, and makes him disgusted with everything.

22. The preparation and administration of fluids, where patients are on fluid diet, require thought, skill, patience, and conscientiousness. Don't consider your duty done because you offered the patient some fluid you had prepared but which he refused—"didn't care for any." Don't let him starve, die before your eyes for want of food. See that he gets something that he will care for. Give it very slowly. It may be only a teaspoonful every quarter of an hour or every half hour, but don't be satisfied until he gets all of it. Don't chart untruthful, misleading statements; for instance, that the patient has had six ounces of fluid because the cup holds that much, when perhaps he has taken only a few sips of it. He probably would take all of it if given slowly and at a time when he can take it. Study your patient and find out when food seems tempting and desirable to him. Many people enjoy food best after a sleep and the sick can usually take food best after a restful sleep. Don't allow the patient to become so faint and fatigued for want of food that the mere exertion of taking it is too much for him. Give nourishing, stimulating and refreshing fluids at suitable hours; for instance, give stimulating fluids, such as hot coffee, early in the morning when the temperature is normally at its lowest degree, showing that life activities are also at their lowest. In the afternoon the body temperature increases due to the digestive processes and other activities of the day, and the patient is apt to be hot, uncomfortable and tired—refreshing drinks are then very acceptable. Stimulating fluids should not be given at night because they prevent sleep. Warm milk may be given but not too hot as all hot fluids are stimulating. Nourishing fluids are given during the day.

Do not allow the patient to exert himself. Support his head by placing your hand under his pillow to the opposite shoulder and elevating it. Do not give nourishment directly after some necessary exertion or painful experience—the hot, trembling hands and lips, the dry mouth, and difficulty in swallowing, show that the patient is in no condition to digest any food.

Be very careful in giving milk to sick people. Give it very slowly, in sips; give a drink of water after it to prevent particles of milk from being caked in the dry mouth. See that the mouth is well rinsed. It must be given slowly so that it will be more finely divided and not form a hard curd in the stomach, difficult to digest. Also see that milk is in perfectly fresh condition and not given so frequently as to create a distaste for it. Milk is a perfect food, highly nourishing and necessary in a liquid diet to secure a sufficient amount of nourishment or number of calories. Milk, even when quite fresh and sweet and kept under the most favorable conditions, contains many bacteria which will multiply in the warm stomach and cause fermentation and flatulence if digestion is poor and the milk remains stagnant in the stomach. If the milk is "on the turn," showing that the bacteria have already multiplied and begun the fermenting process, the danger of flatulence is much greater. Flatulence is one of the most dreaded conditions in such diseases as typhoid or pneumonia. Before giving fluids, particularly milk, be sure that the mouth is clean.

23. Note how much the patient has eaten, note what he has eaten and what is not eaten. If he has not eaten a sufficient amount then see that he is given food at another time.

24. Note all symptoms relating to the diet, time or method of feeding, such as nausea, vomiting, diarrhea, constipation, excessive hunger or thirst, polyuria, edema, fever; note any idiosyncrasies for certain foods; note the effect of food—whether it disagrees and whether he has a distaste for it or not; note any gain or loss of weight due to diet.

25. Note and report any physical condition, such as defective teeth, which interferes with mastication or swallowing.

26. In feeding a patient use drinking cups or glasses, cup, saucer and spoon or medicine dropper, glass drinking tubes or straw tubes. Never use glass tubes for children or for delirious patients. When a patient is unconscious as in collapse, shock or coma, etc., it may be necessary to feed him by nasal gavage or rectal feedings. Sometimes, however, even though the brain is neither receiving nor sending out messages to the body, he may, with patience, be encouraged to take liquid food with a spoon. The touch of the spoon to the lips or the gentle pressure of the spoon on the tongue or the presence of food in the mouth may be sufficient stimulus to cause the act of swallowing because it is normally a reflex act, that is brought about by the above stimuli without the direction of the brain. (Experiments have shown that animals may be fed in this way even though the brain [the cerebrum] be entirely removed.) Give the liquid very slowly, see that it does not collect in the mouth or return through the nose and watch the patient's color to be sure the food enters the esophagus and not the larynx as this would strangle him.

Teaching and training in proper food habits, correcting bad habits, teaching the importance of water, thorough mastication, regularity, exercise, sunshine and fresh air in relation to diet; teaching patients how to plan a well-balanced and nourishing diet, and how to prevent constipation and other digestive disturbances are among the most worthwhile contributions which a nurse can make toward the future health of her patients.

THE FEEDING OF INFANTS AND CHILDREN

Nearly all infants in a hospital are on artificial feeding, that is, they are given a substitute for mothers' milk and are fed from a bottle or with a medicine dropper.

The doctor prescribes the feedings. An older nurse prepares them, but a probationer is frequently responsible (under the supervision of the headnurse) for feeding infants and children.

The Importance of Proper Feeding.—Nothing is of more importance in the care of an infant than its proper feeding. Infants and children truly eat to live and not only to live, but to grow and develop until able to care for themselves. They require the same food principles as an adult, but they require relatively a much higher number of calories in order to provide for the important business of growth. As stated in a previous chapter, during the first year, when the infant trebles his weight, the food requirement is 20 calories during the first month, 35 calories during the second, and 45 calories during the balance of the first year for each pound of body weight. In succeeding years as the gain in weight is relatively not so great the caloric requirement gradually diminishes until at the end of the second year 35 calories per pound of body weight and at the end of ten years 25 calories per pound of body weight are sufficient.

To be of value the food must not only contain sufficient calories and the food principles in the proper proportions suitable to the infant's digestion, but it must be in the proper form and the amount prescribed for each feeding must be given regularly and by the proper method.

Method of Feeding Infants.—No matter how careful the doctor may be in prescribing and the nurse in preparing the feedings, the food will be of little value if not given to the baby in the proper way. The following important rules should be observed:

1. Feedings must always be given promptly on time, neither five minutes before or after the regular time. Regularity is very important, as it tends to establish regular habits. If asleep, infants must be wakened at the regular time.

2. The intervals between feedings are determined by the emptying time of the stomach. During the first and second month feedings are given every three hours, except at night, at 6, 9, 12, 3, 6, 10 and 2, making seven feedings in all. At the age of three months and after the intervals are longer—6, 10, 2, 6, and 10—making five feedings in all. After three or four months no feeding is given at night between 10 and 6.

3. Infants should always be changed before feedings so that they will be comfortable, not restless during the feeding, and so that they will not have to be disturbed after feedings. Infants may be played with before feedings, but never during or after

feedings. Play should be in the form of exercise, that is, allowing him to wave his arms and legs about or grasping your fingers and pulling himself up, etc. It rests an infant to take him up before feedings.

4. The food should be at the right temperature—100° F. Care must be taken not to overheat the bottle or the baby might be burned by contact with it. The temperature of the food is tested by shaking some of it on the front of the wrist or back of the hand.

5. The nipples should be removed from the boric acid solution in which they are kept and fitted to the bottle just before giving the feeding. The nurse's hands must be clean. The nipples should be handled as little as possible and should not touch anything before being inserted in the infant's mouth.

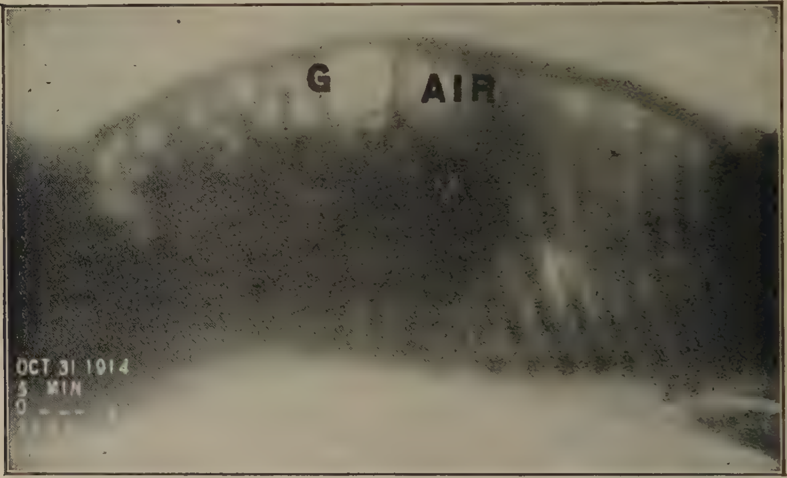

FIG. 1.—SERIES OF X-RAY EXPOSURES BY DR. LEWALD TO SHOW THE SWALLOWING OF AIR DURING FEEDING AND THE METHOD OF GETTING RID OF IT, BY HOLDING THE CHILD ACROSS THE LEFT SHOULDER OF THE NURSE, AS SUGGESTED BY DR. C. H. SMITH. See Figure 5.

Child, aged 4 months; shown also in Figures 2, 3 and 4. One-half ounce of feeding was taken in the first two minutes. Plate taken five minutes after the feeding was begun. Note the small amount of milk in the stomach with a small bubble of gas anterior to it. There is much gas in the small intestine.

G indicates gas in small intestine.
A " air in stomach.
M " milk.

The size of the hole in the nipple and the rate at which the milk flows are very important. It should be large enough to allow the fluid to drop without shaking the bottle. It is better to have the hole a little too large than too small, but the flow must never be more rapid than the infant can comfortably stand. A small hole irritates an infant, uses up energy, wears him out before he has had enough food to satisfy his hunger, and also causes him to swallow air in sucking. Loss of energy is particularly to be avoided with weak infants. A hole of the right size may be made by puncturing the nipple with a heated needle.

6. The position of the infant is very important. The head and chest should always be higher than the abdomen so that if air is swallowed or gas forms in the stomach it will collect at the cardiac opening or entrance to the stomach so that it can be belched up without the expulsion and loss of the feeding. Infants should always be taken up, if possible, during feedings. Care must be taken that they are properly protected from exposure and cold.

The accompanying illustrations show the effect of position on the collection and eructation of air and gas in the stomach.

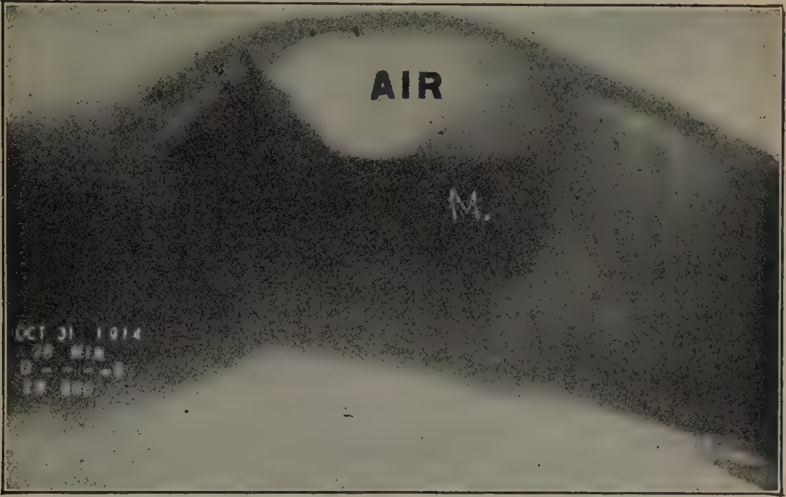

Fig. 2.—The Child Was Then Given 3 Ounces More Food. Child seemed in pain, cried and regurgitated a small amount. Note the *large* amount of air which has been swallowed, distending the stomach.

A indicates air.
M indicates milk.

If each infant cannot be taken up during the feeding, he should be turned on his side in a comfortable position. The head of the crib may be raised a little, or the head and chest of the infant may be raised on a pillow. If the bottle is placed on a frame it must be securely fastened in place so that the infant sucks milk and not air. The position of the bottle must be altered as the level of the milk changes.

7. Infants should be closely watched during feedings to see that they are taking the food properly. If active or restless, or if their attention is distracted, even a slight movement of the head may displace the nipple from the baby's mouth so that he

cannot get it again. The bottle may be displaced, the nipple soiled, the milk drop on the infant's gown, around his neck, or in his ear, etc. If the flow is faster than the infant can manage the milk will run from his mouth to his gown, etc. In such cases it is difficult to tell whether the wet gown is due to regurgitation (simple overflowing from the stomach) or to the belching or eructation of gas and food from the stomach, or to the above causes.

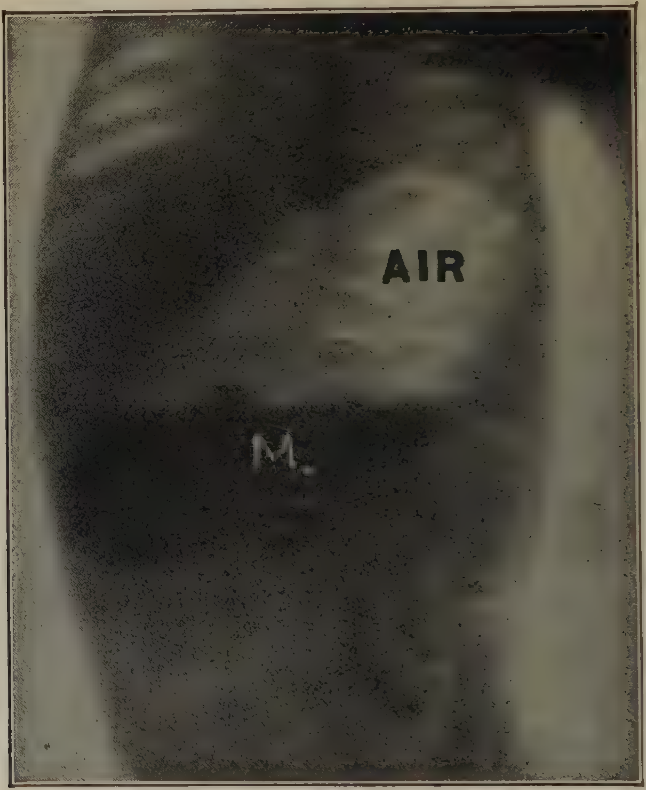

FIG. 3.—THIRTY MINUTES AFTER FEEDING WAS BEGUN. Erect position. Milk (M) has gravitated to the lower part of the stomach, forcing air (A) to the upper part. After this the child was held in the upright position as shown in Figure 5. There was a large eructation of gas. The child at once stopped crying and went to sleep.

8. The duration of the feeding should be from ten to twenty minutes. It is better to err on the short side. An infant must not be allowed to nurse slowly. He must be kept at it and not allowed to go to sleep. It is important that he gets all the food that is ordered. Don't play with him or distract his attention. A prolonged time in feeding tends to air swallowing. Air swal-

lowing fills the stomach before the infant has enough food, causes pain, discomfort, irritability, and distaste for the food. Regurgitation, eructations, vomiting and loss of weight follow. If the feeding is prolonged also the food becomes cold and is apt to cause colic.

9. While feeding an infant if regurgitation occurs before enough food has been taken to fill the stomach, it is probably due to air or gas. The stomach must be relieved before more food can be given. Support him in the sitting position or hold him over your shoulder and lightly pat his back to aid in the expulsion of the air. The benefit of this may be seen in the x-ray plates shown in figures 3 and 4.

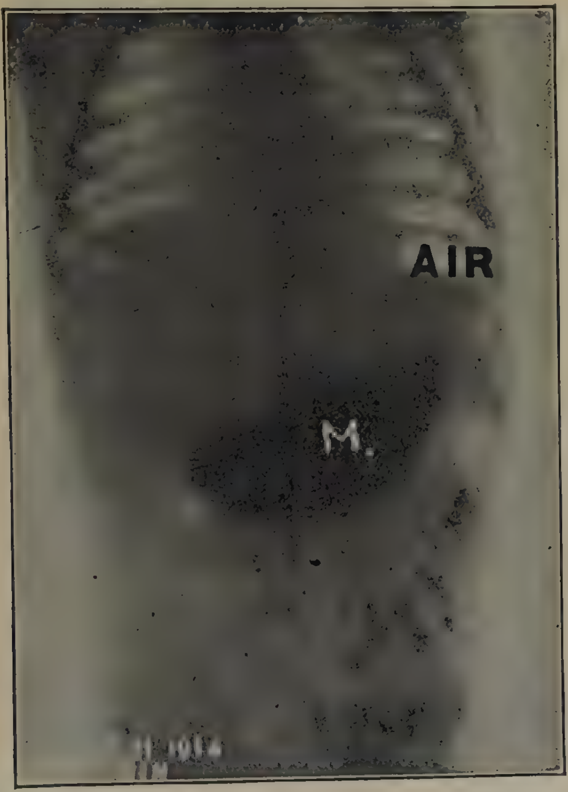

FIG. 4.—AFTER ERUCTATION OF GAS OBSERVED IN FIGURE 3. Note the stomach has become normal in size and shows only a small air (A) bubble which is always present. The child then became free from pain and stopped crying.

10. After feedings an infant should be raised gently and held over your shoulder and his back should be patted until all air has been expelled. He should then be placed quietly and

gently in his crib, the head of which should be elevated. Never rock or play with an infant after feedings. He should go to sleep.

11. Chart the amount of food taken. Note the amount of regurgitation, if any. Note also the symptoms and signs of improper or insufficient feeding. Improper feeding may be indicated by a distaste for food, belching or eructations, vomiting, crying, colic, flatulence, diarrhea, or constipation, the character of the stools, fever, wakefulness and fretfulness. Other symptoms and signs are pallor, anemia and a failure to gain or a loss in weight. Failure to gain weight in an infant is equivalent to loss of weight in an adult.

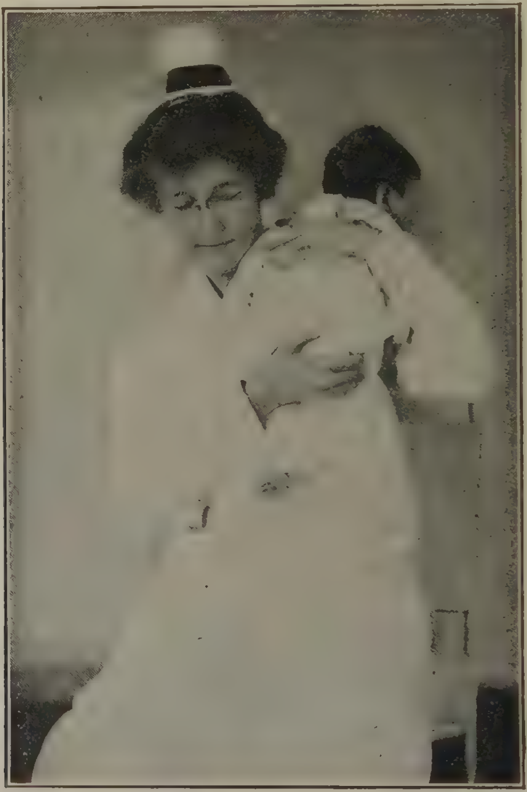

Fig. 5.—Proper Position in Which an Infant Should Be Held After Feeding. Air is swallowed with food by all infants. See Figures 1, 2 and 3. Immediately after feeding, the infant should be held up against the shoulder of the mother or nurse to encourage the eructation of the swallowed air (Smith and LeWald).

12. Nipples and bottles should be put to soak in cold water immediately. Nipples are boiled daily and kept in boric acid

solution until used. Bottles are washed with soap, hot water, and a brush and sterilized by boiling before use.

13. Water should always be given to infants between feedings. They sometimes cry, not because hungry but because they are thirsty. Lack of sufficient water prevents heat elimination through perspiration. As explained previously in this chapter there is a very definite relation between the fluid balance in the body and fever. Fever may be caused by depriving the system of water, showing its importance in the proper metabolism and functioning of the body.

14. Finger sucking must be prevented at all times, as it causes air swallowing.

The Feeding of Premature Babies.—The feeding of a premature baby is usually the responsibility of an older nurse, as these babies require the most expert care. They are very weak and fragile and extremely sensitive to cold. Their powers of producing heat are very poor and they also radiate relatively more heat than larger babies, because their body surface (as is that of all small animals) is relatively greater for their size or volume than that of larger infants or children. The temperature is therefore subnormal and as the body cannot live with a constant subnormal temperature, premature babies must constantly be surrounded with heat. During feedings they should never be removed from the source of heat. They are usually too weak to take feedings from a bottle, so are fed with a medicine dropper.

Diet During the Second and After Years of Childhood.—In artificially fed infants many doctors begin to add semi-solid food at the seventh, eighth or ninth months. The tendency to-day, however, is to begin to add semi-solid food after the fifth or sixth months. Orange juice having been begun at early infancy, at about the fifth month small amounts of well-cooked cereals such as farina, cream of wheat, wheatena, and others of choice are added to the diet. As the child becomes accustomed to feed from a spoon or cup a new article of diet may be added each few days until by the end of the first year or when the infant weighs 20 pounds the entire list of foods prescribed for the first year is completed. This list usually includes the following articles of diet: milk, orange juice, well cooked cereals, zwieback, toast, stale bread, graham crackers, coddled, soft-boiled or poached egg, baked or mashed potato with beef juice, well cooked rice, spinach, peas or carrots well cooked and passed through a sieve, junket, custard, cornstarch pudding, bananas, stewed prunes, and other stewed fruits puréed. Boiled water should be given between feedings.

Between the ages of two and six other solids are gradually added to the list. These consist of meats such as chops, beefsteak, chicken, fish and bacon; vegetables such as squash, string beans or cauliflower, and desserts such as rice or bread pudding, stewed fruit and ice cream.

Never give children the following articles: tea, coffee, fried foods of any kind, fresh bread, cake, pie, fried cakes or rich puddings, pork, veal, kidneys, greasy stews or gravy, corn, cabbage, cucumbers, nuts, raisins, sugar, sweet preserves or candy, except a small amount at meals as dessert.

The Proper Method of Feeding.—The proper method of feeding is quite as important during childhood as during infancy. The proper selection and preparation of food, the total number of calories, the amount at each meal, the intervals between meals, the duration of the meal and acquiring proper habits of eating are all equally important. The growth and development of the child, his resistance to disease and his general health not only during infancy and childhood but throughout his whole life depend to a large extent on proper feeding and the acquiring of proper habits in childhood.

The following rules should always be observed:

1. A child should always have his face and hands washed and his hair brushed before meals. The bed and surroundings, and the child himself, should be neat and clean and the room should be quiet and orderly. Clothing should be protected with napkins.
2. A nurse should always supervise the serving of meals. As in serving adults the food should be served promptly in the proper proportions, and made as attractive as possible.
3. The child should be taught to eat slowly, to chew the food well and to eat neatly. No child is too young to learn good manners.
4. He should be made to eat the food provided and should be allowed to go hungry if he will not eat the proper food.
5. He should not be allowed to eat between meals. Food brought by relatives should be given only at meal time.
6. Water should be given freely between meals, but little should be allowed at meals. The child's tendency is to wash the food down with water or milk without proper mastication.
7. Children should always rest for half an hour after meals.

CHAPTER X

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY EXERCISE, REST AND SLEEP

In the nursing care of sick people one of the most influential factors and one of the first and most responsible duties of a nurse is to see that her patients have sufficient physical and mental rest and sleep. Sleep is often of much greater importance than all the other measures devoted to the treatment of the disease itself.

Exercise, mental and physical, is also one of the fundamental needs of the body just as are food, rest and sleep. Every organ in the body is affected by the activity or non-activity of the skeletal muscles. Sick people usually suffer sadly from lack of exercise. The amount permitted will depend upon the patient's condition and will be prescribed by the doctor. That is, he will state whether the patient may go to work, or walk up stairs, or be up the whole or part of a day, or whether he may sit up in a chair, or in bed, with or without a backrest, or, perhaps, that he may not sit up at all. The object is to regulate the expenditure of energy. But there are other ways in which the patient's energy may be expended or conserved and these must be regulated by the nurse. That is, it may be highly desirable for the patient to have the exercise of turning, moving about freely, or of feeding himself, or of assisting with his bath; but then, again, it may not—it may be harmful. It may be well for him to have mental and physical exercise in the form of visitors, conversation, reading, knitting, or sewing, but, again, it may not. Again, when the patient cannot have *active* exercise, *passive* exercise in the form of massage may be given to supply the benefits of exercise and, at the same time, conserve the patient's energy. Keeping the patient warm and proper nourishment are also means of conserving energy. Strong emotions, disturbing thoughts and dreams, pain, muscular tensions, and all forms of discomfort and restlessness are a serious drain on the patient's energy and should be avoided.

In these and many other questions of exertion and rest the nurse must regulate the expenditure or conservation of energy. To do so will, in all cases, require sound judgment based upon knowledge, keen observation, and experience. One cannot be guided entirely by the patient's wishes or feelings—the nurse must *know*. For instance, a patient with heart disease, or convalescing from diphtheria or typhoid fever, may feel like assisting with his bath, or a patient with phlebitis may request to be rubbed, but, in each case, to permit it would be harmful and, perhaps, even fatal. To *know* and to *practice* the proper use of exercise and rest in such matters in the daily care of patients is *nursing*. The following table shows the energy expended in certain activities:

ENERGY EXPENDITURE PER HOUR UNDER DIFFERENT CONDITIONS OF MUSCULAR ACTIVITY [1]

Form of Activity	Calories per Hour Per 70 Kilograms (Average man)	Per Kilogram	Per Pound
Sleeping	65	0.93	0.43
Awake, lying still	77	1.10	0.50
Sitting at rest	100	1.43	0.65
Standing relaxed	105	1.50	0.69
Hand sewing	111	1.59	0.72
Knitting	116	1.66	0.75
Dressing and undressing	118	1.79	0.81
Walking slowly	200	2.86	1.30
Walking moderately fast	300	4.28	1.95

The Importance of Sleep.—Sleep, with rest of mind and body, is absolutely essential to the patient's recovery. One hour of natural sleep, Nature's restorative, restores the patient more than all the methods devised by man. Our whole mental and physical welfare depends upon it. The brain controls all our conscious life and regulates the functions of the whole body. It is our delicate, highly developed and highly specialized nervous tissue of the brain which makes us differ from animals, enabling us not only to adapt ourselves to our environment, but to adapt our environment to ourselves. The cells of this very delicate nervous tissue are subject to the same laws as other cells. They become fatigued by overactivity or excitement, by depression and lack of use, and by the accumulation of waste products which act as poisonous drugs paralyzing all the activities of the brain, and, therefore, the function of many organs. The worn-out cells must have rest and sleep to rebuild and repair the damage.

There is nothing more trying and exhausting than sleeplessness. The whole appearance and condition are changed after a quiet, restful sleep which must be secured at all costs. "One of the most dreadful punishments that the Chinese have is to kill a man by want of sleep, and he generally dies in less than a fortnight from the time that the punishment begins."[1] Every sensation of pain, discomfort, fear, worry or distress of every kind is magnified a hundredfold during a sleepless night. It is the time when doubts and fears assail us. Even in health one hour seems like a whole night. The sick dread the night and say that they always feel worse at night.

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[1] Sherman, Henry C., Ph. D., Sc. D., "Chemistry of Food and Nutrition."

The Causes of Sleep.—The following are commonly accepted as the causes or conditions accompanying sleep:

1. Anemia of the brain.—The brain must have blood to carry on its work; therefore, by lessening the volume of blood flowing in the vessels of the brain, we lessen all its activities.

2. The withdrawal of all stimuli or messages, through the eyes, the ears, the sense of touch or smell, the thoughts, and other pathways. Messages either directly stimulate the cells of the brain or stimulate the circulation.

3. The accumulation of waste products in the body as, for instance, following exercise in the open air, due to the increased metabolism or combustion.

Recently it has been suggested that the circulatory changes present in sleep are the result and not the cause of sleep; and that sleep, or unconsciousness, is not merely passive but is actively brought about by an exchange of control in which the more primitive, automatic functions and activities of our subconscious brain replace those of our conscious brain, and thus the regulations and control of the higher conscious life are removed. Whatever precedes the period of sleep, or unconsciousness, in our thoughts, activities, and surroundings, has a marked influence on the activities of the subconscious brain, resulting sometimes in "bad" dreams and disturbed, restless sleep which rather exhausts than refreshes, and one awakes with an uneasy feeling of impending trouble. These are important factors for us to consider in both the preparation of our patients for sleep and in observing the character of their sleep. It is in regard to such matters that study of the individual needs of patients, spiritual, mental, social, and physical, becomes particularly significant.

How to Secure Anemia or a Lessened Volume of Blood in the Brain.—There is only a certain volume of blood in the body—if the volume is increased in one part it must be lessened in another. The circulation is greatly affected by position, the condition of the heart and blood vessels, the quality of the blood, the digestion, the temperature of the body and surroundings, the occupation, mental and physical, and the emotions.

Numerous experiments show that there is a lessened amount of blood in the brain during sleep. The lessened activity is shown by the slower pulse rate and respiration.

1. Have the patient lie down. The heart beats more slowly and is therefore sending less blood to the brain. When sick people are obliged to sit up constantly (usually because of heart disease with poor circulation) their sleep is very fitful so that

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[1] Lectures on the Action of Medicines by Dr. Brunton.

they must have very tender care. Avoid all causes of restlessness, for, when the body is still the circulation is slower and less blood is circulating in the brain.

2. Most people, however, must have one or two pillows in order, by position or gravity, to lessen the volume of blood in the brain. Sometimes one will fall asleep when sitting up in a chair (the brain is anemic), but be unable to sleep when at last one can lie down—the change in position has, by gravity, increased the blood supply in the brain. For the same reason anemic patients will be drowsy during the day when sitting or walking, but be unable to sleep while lying down. In anemia the heart is weak and the circulation poor, so that during the day when standing, sitting, or walking there is an increased volume of blood, by gravity, in the extremities and in the muscles where it is necessary for their work in walking, etc. When the anemic patient is lying down, the feet being elevated and the muscles at rest, the blood returns to the heart and is pumped to the brain, which as a result then becomes active, because the relaxed anemic blood vessels have lost their tone and cannot contract to prevent congestion. Sick people are very frequently or usually become anemic so that special care is required to prevent sleeplessness.

3. Active brain workers, sometimes, can only sleep with the head elevated with several pillows because the congested blood vessels keep the brain active. Try to keep patients from reflection, reading or work requiring thought just before bedtime. Protect patients from conversations with visitors, and anything likely to excite painful emotions, such as excitement, anger, irritability, (note the flushed face, indicating congestion, with excitement, or anger), fear, worry or nervousness. For instance, do not keep a patient waiting for the bedpan, for medications and other similar necessities, until the patient is too uncomfortable, "too upset," or "past" sleeping. All of these conditions increase the volume of blood in the brain. Cold compresses applied to the head, or rubbing the forehead with a volatile liquid, like aromatic spirits of ammonia or alcohol, are cooling, and will frequently relieve the congestion and sleeplessness.

4. Massage of the limbs, back, or back of the neck, a hot bath or foot-bath, the blanket pulled well up over the shoulders, a hot-water bottle to the feet or abdomen all increase the volume of blood in the body and extremities, and therefore lessen the supply in the brain. Sometimes patients cannot sleep because too cold, especially if their feet, shoulders or abdomen are cold: Note how one draws the knees up in the effort to protect and warm the abdomen, for there is a direct relation between the blood vessels and blood supply of the feet, abdomen, and brain. When the feet or abdomen (the stomach and intestines) are cold, there is less blood there and more in the brain, so that the application of warmth—an extra blanket or a hot-water bottle—acts as a powerful hypnotic. *Old people* in particular require special

care at night. Their circulation is poor and they are apt to feel the cold very quickly. Always see that they have extra warmth. Again there is a saying that a man is as old as his arteries, which means that as one grows older the arteries lose their tone or elasticity, the power to contract or relax promptly as they should to the pressure of blood, so that they do not contract readily when one is lying down or regulate the supply of blood in the brain. Massage lessens the rigidity of the blood vessels, and makes the circulation more normal so that it is very beneficial for old people.

5. Sometimes patients cannot sleep without something to eat. One of the first duties of the night nurse is to give her patients a hot drink. This draws the blood away from the brain to the abdomen. This is illustrated in the following amusing and instructive tale told by Dr. Brunton. "Perhaps one of the best expositions of sleeping and waking ever given was that of Mayow, who lived about 200 years ago, and in his time people said that all the functions of the body were carried on by what they termed vital spirits. These were supposed to be little imps that were present all over the body, and each one had its work to do; and 'if,' said Mayow, 'a man takes a big dinner, all the vital spirits have to go down into the stomach in order to carry on digestion, and the man naturally goes to sleep, and cannot easily think; but if the man will try to think after his dinner, and succeeds in doing so, the vital spirits will go up to his brain to do the thinking, leaving the stomach to its own devices, and consequently the food is not digested.' If we substitute the word 'blood' for 'vital spirits' we have here a very good exposition of the modern physiological theories of digestion and of sleep."

When applying heat to the external abdomen or to the interior of the stomach, see that the hot-water bag or the drink is not too hot. The stomach being near the heart and being very richly supplied with blood vessels, the heat may stimulate the heart and the circulation and in this way increase instead of lessen the blood supply of the brain.

To Induce Sleep by the Withdrawal of all Stimuli or Messages to the Brain or Spinal Cord, that is, to shut it off from all disturbing factors in the body itself or its surroundings.—These stimuli are conveyed through the eyes, ears, sense of smell or touch, the sensations of heat, cold, pain, discomfort, an uncomfortable position, or close, stuffy air. Messages are constantly being sent to the brain or cord (even when we are sleeping) for the sentinels or nerve endings are always on guard and, sometimes even though we are asleep, the brain or cord will respond. For instance, when asleep in an uncomfortable position a healthy person will often change this position without waking; or when too hot or too cold will throw the clothes off or pull them around him without waking. Notice a person asleep when sitting up in a chair, how the head nods, the body sways, but with convulsive jerks swings back into position, maintaining its equilibrium without waking. Such a sleep (disturbed by dreams or discomfort, etc.), is not the sound, healthy, restful sleep one desires for the sick. A sick person will not be able to make these adjustments and will probably be aroused from his sleep and be unable to sleep again. A nurse must see that nothing disturbs the patient's sleep, especially during the first sleep, for the shock of being aroused makes the brain wide awake and intensifies a hundredfold all the pain and worry, that would have been dulled and driven away by a more prolonged sleep. "The more the sick sleep the better will they be able to sleep."

To withdraw all stimuli, have the room darkened, quiet and well ventilated. See that the patient is free from excitement or worry and not "past her sleep" from nervousness or any other cause. Allow no painful dressings or treatments, no startling news or noises, such as rattling of dishes, windows, or utensils, banging doors, or cracking ice. The nurse herself must be quiet in her movements and speech. See that the number of visitors is limited, that the ward is quiet during the visiting hour, that visitors do not in any way annoy or disturb very sick patients, and that they do not stay too long. See that the patient is comfortable and warm, free from hunger and thirst, and that all her needs (such as the use of the bedpan) and requests are attended to.

Sleep May Be Produced by the Accumulation of Waste Products in the body, which act as a drug or poison. It has been suggested that this explains why a bird sleeps with its head under its wing, why a dog sleeps with its nose buried under its paw and why some people sleep with their heads covered by the bedclothes. In each case the elimination of carbon dioxid and the absorption of oxygen is interfered with. One usually goes to sleep as soon as the head touches the pillow after exercise in the open air, due to the absorption of a large amount of oxygen, increased combustion and increased formation and accumulation of carbonic acid gas. During the day the waste products of metabolism accumulate and in time act as a hypnotic. During sleep these are gradually eliminated. Sick people are denied this healthy form of exercise so that sleep does not come so readily.

Drugs—hypnotics, narcotics or soporifics—are to be used only when absolutely necessary. The order left for a hypnotic frequently reads, "to be given if necessary." Here is an opportunity to show what intelligence and skilled nursing can do. Every art should be tried before resorting to the use of the drug which, in most cases, is adding another poison which may interfere with the digestion, the action of the heart or other organs in the already crippled body.

THE PREPARATION OF THE PATIENT FOR THE NIGHT

The **purpose** of the preparation is (1) to find out the patient's mental and physical condition; (2) to refresh after the various discomforts of the day; (3) to remove the causes of restlessness and sleeplessness—worry, excitement, wrinkles, crumbs, aching limbs and back, noise and light, etc.—so that the patient may have a sound, healthy, refreshing and unbroken sleep.

The Condition of the Patient at the End of the Day.—Ward patients are awakened at an early hour; the day is long and may be monotonous and dreary, or the patient may have passed through various trying ordeals and be exhausted by pain, discomfort, by the long day in bed with hot, aching, cramped limbs, by visitors, by worry or excitement and by the active, sometimes trying scenes around him.

The Condition of the Bed and Surroundings.—The bed will often be disordered; the sheets loose, crumpled, wrinkled, hot, damp and covered with crumbs; the pillows will be hot and disordered.

The Evening Toilet.—Screen the patient, and bring the necessary articles—a basin of water, alcohol, powder, comb and brush, mouth wash and articles necessary for cleansing the mouth, clean linen if necessary, and whatever may be necessary for the special needs of the patient.

The patient should be allowed to use the bedpan. If the upper bedclothes are loosened and turned back at the foot (without exposing the feet) the clothing will be aired and cooled, and the feet will be given more freedom. This is very refreshing, after having been tucked in tightly all day.

Cleanse the mouth, face, hands and back. Allowing the patient to dabble his hands in the water is refreshing, soothing and restful. Rub the back with alcohol and powder, giving particular attention to parts which are red (rub until the redness disappears), or in danger of becoming sore. If the patient is wearing a binder, loosen it when washing or rubbing the back. Inspect dressings for bleeding or discharge and see that they are reinforced if necessary. If the patient's gown or binder are soiled or damp, replace them with clean ones. Remove all crumbs from the patient's gown or bedlinen. Loosen the drawsheet, pull it through to give the patient a cool place to lie on. Tighten the under linen so that it will be absolutely smooth and free from wrinkles. Remove, shake, turn, and rearrange the pillows. Brush and comb the hair, if necessary, and other duties allow it. Straighten the upper bedding. If the patient has a hot-water bottle, ice-cap or water pitcher see that they are replenished. Give any special attention the patient may require and attend to all requests.

Report and chart the condition of the patient. Especially note any change for the worse, any signs of restlessness or delirium which are apt to develop and become worse, and perhaps violent and dangerous, during the night. Special precautions must then be taken (such as putting "sides" on the bed, padding them with pillows to prevent him from hurting himself, and moving him to a place where he can be closely watched by the night nurse). The night nurse should be warned of the patient's condition and possible developments. The nurse in charge of the patient during the day should also see that all supplies, dressings, milk, broth, medications, clean linen, etc., which may be required for the patient at night are on hand.

The environment of the patient should also be in order—the table cleared of all fruit, soiled dishes and flowers, etc., and the service rooms left in order.

The Importance of Sleep For Infants and Children

Sleep has an added importance for infants and children. An adult can do with less sleep and less food because he has completed the serious business of growing. He can afford to use all the calories supplied by the food he eats to produce heat and the power or energy to do work, that is, to lead an active life, merely reserving enough calories or energy to repair the tissues worn out in the process. In infancy and childhood, however, besides the calories necessary to produce heat, to produce energy to carry on the processes of life—breathing, circulation, digestion, etc., and to repair tissues, a large amount of energy must be conserved to provide for growth. Growth, developing, gaining strength and the power to protect itself is the body's chief concern during infancy and childhood. During the first year an infant normally trebles his weight. For this reason during the first year an infant requires 45 calories in food for each pound of body weight, whereas a man weighing 150 pounds, while at rest in bed requires only 33 calories. For the same reason infants and children must have more sleep because (1) during sleep fewer calories are used to produce heat; the temperature falls during sleep; (2) fewer calories are needed to produce energy for work or to repair tissues—the body is at rest; there is less wear and tear on the tissues; the pulse and breathing are slower so that during sleep most of the energy can be devoted to growth. Very sick, weak babies usually sleep a great deal, are very quiet, motionless and do not even cry because crying is exercise and uses up energy. This is Nature's way of conserving energy necessary for growth and to increase resistance against the disease.

Sleep is, therefore, essential if the infant is to grow.

The Amount of Sleep Required.—A new-born babe (from birth to the end of the first month) sleeps almost continuously. He does nothing but sleep and eat, sleeping from 20 to 22 hours, usually waking a few minutes for feeding. During the first six months he should sleep from 16 to 18 hours; at the end of the first year, about 15 hours; at the end of the second year, 13 to 14 hours; at the end of the fourth year, 11 to 12 hours, from the ages six to twelve, 10 to 11 hours; from ten to fifteen years, about 9 hours.

Character of the Sleep.—The sleep of the new-born is usually deep. The slumber of a normal infant is sound, natural, unbroken, undisturbed—the soundness of the sleep is an indication of well-being. Wakefulness or a restless, broken slumber is always an expression of illness.

Conditions Necessary for Proper Sleep.—Nature provides for this sound slumber by delaying the development of the nervous system. The brain is not developed, and the sensations of sight and hearing, etc., are not acute. It is, therefore, not necessary to whisper, to keep quiet, or to stop any of the usual activities about the room or ward.

The position of the infant should be changed often during sleep for the same reasons that an adult changes his own position frequently. The soft bones of the head in young infants become flattened and deformed if they are forced to lie constantly in one position. Changing the position will not disturb the sound slumber of an infant, or if it does, he soon falls asleep again.

No pacifiers, finger sucking, rocking, or "walking the floor" are necessary and should not be permitted.

While an infant is not very sensitive to its surroundings, sudden noises, a bright light and all causes of physical discomfort should be avoided. He should have the proper amount of covers, should be dry and warm, but not too warm. Too much heat with perspiration is very weakening. Moisture from perspiration or urine, etc., predisposes to chilling, colds and pneumonia. Fresh air is essential.

Proper habits should be formed from the beginning. An infant should be placed in a dark room, while awake and left unattended. He should sleep the regular amount and be put to bed at a definite time each day and night. As the infant grows older his brain develops and he becomes more sensitive to his surroundings. All causes of mental excitement, of nervousness or fear of the dark, should be avoided. A child should not be told stories which excite or stimulate the imagination. Visits from parents at the evening hour sometimes pacify but often excite the child and make him homesick. A child should not be punished by being put to bed.

Although sleep is essential for infants, they should always be awakened regularly for feedings and they should not be allowed to fall asleep during feedings.

CHAPTER XI

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE BY THE ELIMINATION OF BODY WASTES

"The elimination of effete materials by the kidneys, bowels and skin" is one of the most influential factors in the treatment of all forms of disease, "often of greater importance than the measures devoted to the treatment of the disease itself."

As seen in the previous chapter the health, life and efficiency of the body depend upon the digestion and assimilation of the proper kind of food. But equally important is the elimination from the body of the ashes which remain—the ashes of the excess food we eat which the tissues do not need or cannot use, and the waste products of metabolism together with other poisonous products of metabolism and disease. These wastes, if allowed to remain, would clog and poison the whole system.

The kidneys and the bowels are the most important excretory organs. In any disease, if the kidneys can be kept actively working and the bowels "kept open" so that the waste and poisons are eliminated as fast as formed, the cells can put up a good fight so that the patient has a good chance of recovery. If either one fails to do its work, the whole body will suffer and be clogged up so that the little cells, choked and poisoned by their own excretions, will fail to carry on their work. In sickness the normal wastes of metabolism will be increased by the products of the disease and these wastes may be so irritating and poisonous or so great in amount that the kidneys become overworked, irritated, inflamed and diseased themselves, so that they also break down. This condition is very serious so it is important to watch how the kidneys are working by examinations of the urine. Again, the other organs of the body may be normal, but the kidneys or bowels may be diseased and so fail to excrete even the normal wastes of metabolism or digestion. These wastes must then accumulate and every organ in the body will suffer so that in all cases it is extremely important to note whether the normal quantity and quality of urine and feces are being eliminated. A nurse must therefore never fail to note the number, quantity, and character of the eliminations from the bowels and kidneys. She should never empty a bedpan without first finding out whether the urine is to be measured and charted, whether it is to be sent for examination, whether all the urine voided is to be saved for examination, and whether or not a specimen of the stool is to be saved for examination. The diagnosis, treatment, and recovery of the patient may depend upon it.

The Elimination of Waste Products From the Intestines

The Importance of Regularity in Defecation.—Constipation, or failure of the bowels to eliminate waste matter, is a very common condition, largely responsible for many ills from which the body suffers. Lack of regularity in going to stool at a definite time each day is the most common cause of constipation. As explained in the following chapter, the presence of feces in the rectum normally causes a desire to expel it, a desire which in a healthy bowel must be responded to. If this desire is ignored repeatedly, feces may collect in the rectum and colon without causing any desire to expel it and soon the power to do so is lost. Constipation is the result. Forming the habit of going to stool regularly at a definite time each day is the only permanent cure for constipation.

A patient who enters the hospital may or may not have formed this habit. If he has formed the habit, a nurse must see that no neglect on her part shall interfere with this important function for in doing so she would cause the patient an injury from which he might be a long time in recovering. If he has not already formed this habit, a nurse can do a great deal in helping him to do so while in the hospital.

Regularity in voiding urine is also important.

To preserve or develop this habit, bedpans must be given at regular intervals. With the majority of people the desire to go to stool is felt immediately or shortly after breakfast. Whether the patient desires it or not the bedpan should be given at this time, and an attempt be made to use it. The desire to void urine is felt at more frequent intervals. For this purpose the bedpan or urinal should be given before bedtime, on awakening in the morning, and after each meal. Except under unusual conditions, for instance, when the patient has had a cathartic or has diarrhea or some disease of the urinary tract, which makes frequent voiding a necessity, bedpans should not be given at irregular hours. Every consideration should be shown the patient, however, under the conditions mentioned. If this rule is observed, it will not only be of invaluable benefit to the patient both as regards his present comfort and future health, but will make the work of the ward run more smoothly and efficiently. It will make the use of the bedpan unnecessary during meals, visiting hours, "doctors' rounds" and at other undesirable and awkward moments.

Method of Giving a Bedpan to a Patient.—When giving a bedpan the following rules should be observed: While no false modesty should be shown in regard to the normal and necessary functions of the body, a bedpan should always be properly covered and carried to and from the patient as unobtrusively as possible. The bed should be screened. The bedpan should be warm and should be placed gently under the patient in the proper position. A bedpan with enamel chipped off should not be used on account of the danger of injuring the skin. If necessary to use a chipped bedpan, it should be protected with a pad. A pad should always be used when the skin is tender and in danger of bruising or breaking.

In placing the bedpan, if the patient requires assistance, direct her to draw her knees up and press her heels against the bed. At the same time, slip your left hand under the pelvis, raise the hips, place the bedpan in the proper position, and gently lower her on it. When the bedpan is in use see that the cover is not thrown on top of the bed, table or chair, but place it on the bar of the bed under the bedclothes out of sight, so that the patient need not be embarrassed should someone come behind the screen. Leave the patient alone unless she is very ill or weak and apt to faint or become exhausted. Do not leave the patient longer than necessary on the bedpan.

In removing the bedpan, support the patient as before. Turn her on her right side. Cover the bedpan immediately. If the patient is able to complete the toilet, see that toilet paper, basin of water, and cotton pledgets are at hand and placed conveniently. The patient should be allowed to wash her hands afterwards if desired. If the patient is unable to do this satisfactorily and without fatigue, the nurse must do it for her. The bedpan should be removed as soon as possible and washed first with cold running water, then mopped and scalded with hot running water. Chlorid of lime is used as a deodorant in the pan and hopper if necessary.

What to Observe about the Feces.—The principal points to be observed in regard to the stools are the number of movements in twenty-four hours, and whether accompanied by pain or straining; the consistency, shape, color, and odor of the stool, and the presence of unusual matter. The expulsion of gas or flatus should always be noted.

Number.—There should always be one satisfactory daily movement; with some, two daily movements are normal. When this does not take place it means that waste products are being allowed to accumulate in the intestines. The stool should be formed, but not hard, and moulded to the shape and size of the rectum. When the stool is in small, dark, hard masses it indicates that the feces have been impacted for some time in the bowel, allowing water to be absorbed, making them hard and dark and difficult to pass. This indicates constipation. When the stool is fluid it indicates that there is irritating matter in the intestines which causes them to contract and empty themselves quickly and frequently, so that the contents do not remain long enough to allow the water to be absorbed forming the normal, solid, moulded stool. This may indicate diarrhea, or it may indicate constipation, the irritation being caused by the hard, impacted feces on the lining of the intestines. Any alteration in the shape or size of a formed stool should be noted, as it may indicate a stricture or obstruction of the intestines, due possibly to the presence of a tumor, such as carcinoma.

The *color* of feces is normally a *greenish brown,* due chiefly to the coloring matter in the bile. Bile is secreted by the liver and flows into the small intestines during digestion. If the stools are *pale or "clay-colored"* it indicates an absence of bile. This is a serious condition because it indicates either that the liver is not secreting bile, or that there is some obstruction to its passage into the intestines. In that case it would pass into the blood stream and the patient would be jaundiced. Light colored stools may also be due to the presence of undigested fat. When the stool is *dark* and of a *"tarry"* consistency, one suspects the presence of blood which has remained in the intestines long enough to be partly digested. Digested blood means that the red cells in the blood have been broken up, setting free the hemoglobin, which in turn is broken up, setting free hematin, a brownish coloring matter which gives the stool a very dark color. A dark, tarry stool therefore indicates that a hemorrhage into the intestines occurred some time previously, and that it probably occurred high up in the intestines, or that it came from the stomach where digestion is taking place. *Bright red* blood in the stool indicates either a very recent hemorrhage or one from the lower portion of the intestines where there is no digestion. Blood coming from the lower bowel will be on the surface of the stool, while blood from the stomach or small intestines will be mixed throughout the stool.

The color and odor of the stool vary with the different foods eaten, and are also altered by various drugs which may be taken. For instance, a green color may be due to the chlorophyl from vegetables. Iron and bismuth preparations turn the stools black, while calomel turns them to a greenish color.

The *odor* of the stool, as a rule, has no particular significance but an unusual odor should be noted. It may be due to drugs, but is usually the result of putrefaction of protein in the accumulated feces in the intestines resulting from constipation. The feces will be dark in color.

Gas expelled should always be noted. Gas results from the fermentation of carbohydrates in the accumulated feces. The feces will be light in color and acid in reaction.

The *presence of unusual matter*—blood, pus, mucus, worms, etc.—should also be noted and reported.

The presence of *mucus* indicates irritation or inflammation of the mucous lining of the intestine—irritation of any mucous membrane results in increased secretion of mucus. The process in the intestines is the same as that in the nose or throat and the secretion will have the same characteristics as the secretions from the nose with a "cold in the head," or as the phlegm from the throat. Mucus in the stool gives it a slimy appearance. When the inflammation is in the small intestines, where digestion and peristalsis are active, the mucus wil be mixed with the stool. When the irritation is in the colon, the mucus will be on the surface of the stool. In severe forms of inflammation, as in dysentery, the stool may consist of nothing but mucus and blood and is accompanied with severe pain and tenesmus.

The presence of mucus should always be reported as the condition may become very serious and very difficult to cure.

Blood in the stools (or in any discharge from the body) should always be looked upon as a matter of the gravest importance. It may be due to a slight irritation from straining in constipation and hard, fecal matter, but it may indicate a very severe irritation or inflammation of the intestines, ulceration,—gastric, duodenal or typhoid ulcers,—carcinoma of the rectum, hemorrhoids, or diseases resulting in hemorrhages into the mucous membranes, such as scurvy, leukemia, and purpura, etc.

The color of the blood, whether on the surface or mixed throughout the stool, whether passed with or after the stool, whether accompanied by pain or straining, and the amount should be noted and charted. It must not be confused with blood from the vagina in menstruation.

Pus in the stool is the result of severe inflammation in the intestines, liver or pancreas, with suppuration, or it may be due to the rupture of an abscess into the intestinal tract.

Intestinal Parasites.—The intestinal parasites most commonly found in the stools are the *pin-worm or thread-worm* (*oxyuris vermicularis*), the *round-worms* (*Ascaris lumbricoides*), the *amœba,* the *hookworm,* and the various *tapeworms.*

The *pin-worm* or thread-worm occurs very commonly in the rectum and colon. Its presence causes itching, irritation, restlessness, loss of sleep and appetite, and finally, anemia. It appears in the stools as fine threads usually moving actively.

The *round-worms* are very common intestinal parasites occurring chiefly in children. They cause restlessness, irritability, twitchings, and convulsions. They are easily recognized in the stool.

Prophylaxis.—When either pin-worms or round-worms are found in the stools, the greatest precaution must be taken to prevent spreading the infection to others and also to prevent the patient (usually a child) from re-infecting himself by contaminating his hands. They enter through the mouth. The anus and surrounding parts must be carefully washed and also the hands of both patient and nurse. Infected persons should never be allowed to handle foods.

The *amœba* is the cause of amœbic or tropical dysentery resulting in severe inflammation and ulceration of the intestines and abscesses in the liver. The stools contain the amœba and so are highly infectious. Strict precautions must be taken to prevent the spread of the infection. The amœba is a one-celled organism which can only be seen under the microscope.

Tapeworms.—These are taken into the alimentary tract in infected pork or beef, etc., which has not been thoroughly cooked. They lodge in the intestines and cause pain, nausea, diarrhea, and anemia, and give the patient much anxiety and worry. They may be from five to twenty feet or more in length. Segments may be passed frequently in the stool, but as long as the head remains the worm will continue to grow. When treatments are given, therefore, to expel the tapeworm, a nurse must look particularly for the head, which is very minute, about the size of a pin's head, with a very fine neck like a thread. It is difficult to find—several feet of segments may be passed at different times without the head, but this does not relieve the condition.

Prophylaxis.—All segments should be burned and never thrown into the closet. When the stool is to be examined for a tapeworm it should be received in a bedpan containing water at body temperature. Look for the head. Some doctors advise that the patient should sit on a commode containing steaming water as hot as he can stand. It is said that this furthers the expulsion of the worm.

When a stool has an unusual appearance, indicating the presence of mucus, blood or pus, etc., it should be saved undisturbed for inspection by the doctor, who will decide whether a specimen should be sent to the laboratory for further examination or not. In any case, when it is suspected that the stool contains any abnormal substance, parasites or blood, etc., and an examination will aid in the diagnosis, a specimen will be required for examination. Usually only a small amount is required, but sometimes it is necessary to save the whole amount undisturbed.

The Collection of a Specimen of Feces.—When a specimen of feces is to be sent to the laboratory for examination, it should be placed in a clean, proper receptacle which will allow no leakage. Too much must not be placed in the receptacle, which might allow it to contaminate the cover or the sides, or cause it to spill in transit. It should be properly covered and labeled with the name of the ward, the patient's name, the date, and the tag should indicate the hour at which the stool was passed and for what the specimen is to be examined. Stools should always be sent to the laboratory when quite fresh. When the stool is to be examined under the microscope for amœba or other protozoa, it should be sent while quite fresh and warm. It must be examined while warm, because the parasites can only be detected by their movements and cold checks their movements. When stools are collected and sent to be examined for *bacteria,* such as the typhoid, tubercle, or cholera bacillus, the greatest precaution must be taken to prevent spilling in transit, or contamination of the cover or outside of the container which would endanger the person who handled it in examination of the stool. The receptacle should be sterilized, before use, by boiling—no disinfectant should ever be used in the receptacle or mixed with a stool required for examination.

Charting.—The number of movements daily is recorded on the chart as long as the patient remains in the hospital. Any abnormality in the character of the movement is also charted. A specimen sent to the laboratory is recorded.

When the number or character of the stools indicate that body wastes are not being properly eliminated, or that the intestines are diseased, enemata are usually ordered to relieve the condition.

ENEMATA

Enemata are among the treatments usually included in the duties assigned to a young student nurse.

An enema or clyster is an injection of fluid into the rectum.

Purposes of the Treatment.—(1) If the number or character of the stools indicate that waste products are not being eliminated properly, the doctor may order a cathartic or a *cleansing enema* to be administered. (2) When abnormal matter in the stools indicates a diseased condition of the intestines *local, remedial applications* may be made by means of rectal injections. (3) Medications, fluids or nourishment may also be given by rectal injections to produce a *general effect* on the whole system.

The kind, amount and temperature of the solution used and the method of giving the treatment will vary according to the purpose for which it is given.

THE CLEANSING OR EVACUATING ENEMA OR CLYSTER

The word *clyster* comes from a Greek word *klysis*, which means a washing out of stagnant or waste materials in any cavity (or in the blood) by means of injections of fluid.

The Causes and Results of the Accumulation of Feces.—Feces consist of undigested food, intestinal secretions, shreds of mucous lining and bacteria—one-third of the bulk of feces is bacteria. Normally the rectum is empty and when fecal matter is passed into it from the colon, the desire to expel it is instantly felt, for "the rectum is *not properly a reservoir* for feces, and in the healthy condition the presence of the latter stimulates it to contract" (Woolsey). This is because the nerve endings (the sentinels on guard to warn of danger and guard from injury) if not too dull and depressed, immediately send a message of pressure or irritation along the nerves to their cells or centers in the spinal cord, which in turn send a message back by other nerves to the nerve endings in the muscles of the rectum, which causes them to contract and expel the substance causing the irritation or pressure. If for any reason this desire is ignored or neglected frequently, the nerve endings lose their sensitiveness, fail to play their part as sentinels, and large amounts of feces may collect without any desire being felt to expel them. Also, from lack of use and other causes, muscles may lose their tone or the continued pressure and distention with fecal matter and gases may paralyze them so that they become unable to contract with sufficient force to expel the feces when the desire is felt. The accumulated mass in the colon, laden with bacteria, ferments and putrefies, with the formation of gases and toxic products which are constantly being absorbed and so poison the whole system. This is called auto- or self-intoxication. The result is headache, loss of appetite, mental dullness, and a general feeling of lack of fitness.

The **purpose of the treatment** is to soften hardened fecal matter and to remove any fermenting, putrefying matter, together with the toxic substances and gases which may have accumulated in the rectum and lower colon, and to do this with the least possible physical and mental discomfort to the patient.

The removal of the hardened, accumulated mass may be accomplished in several ways:

1. *By Mechanical Means:*

(a) Softening and disintegrating it by the use of softening agents—water, soapsuds, glycerin, olive oil, ox gall and normal saline solution, etc. Glycerin, when used, aids the penetration of water and so increases its softening effect.

(b) By using a large amount of water and so distending the rectum and colon. This mechanical pressure stimulates the nerve endings to such an extent by a reflex action that the muscles are forced to contract to expel it.

2. *By Physical Means:*—Using a hot (or cold) solution which stimulates the nerve endings and reflexly stimulates peristalsis.

3. *By Chemical Means:*—Using irritating substances, such as soapsuds, turpentine, etc.

Varieties of Cleansing Enemata:

1. *Simple Soapsuds Enema.*—A mild soapsuds solution is made by dissolving a *slightly* irritating soap, such as castile or ivory, in hot water. All froth or air bubbles should be removed to avoid the entrance of air into the intestines as this would cause pain and interference with the injection of the solution. From two to three pints of this solution are usually used for an adult and from one to one and one-half for a child. More than this should not be used without a doctor's order on account of the danger of overdistention of the intestine and injury to its walls. The *temperature* should be from 106° to 110° F. The enema is not to be retained. Its effect is due to the mild irritation of the soap and the pressure due to the large volume of water.

2. *Oil Enema.*—Before giving a soapsuds enema, an injection of oil is sometimes necessary in constipation to soften hard masses of feces. Oil enemata are, also, frequently given before the first bowel movement after operations on the rectum or perineum such as for hemorrhoids or a perineorrhaphy, in order to avoid straining and injury to the sutures and wound. The enema may consist of six ounces of olive oil, or to this may

be added two ounces each of caster oil and glycerin, to aid the softening effect. The oil is prepared by warming it to a temperature of 90° F. An oil enema should be retained. It may be followed in one hour by a soapsuds enema or it may be retained from two to six hours before the soapsuds enema is given.

3. *Medicated Purgative Enemata.*—In obstinate constipation rectal injections of various cathartics may be necessary to hasten or to cause free evacuation. The cathartics commonly used are glycerin, fel bovis or ox gall, Rochelle Salts and Epsom Salts (Magnesium Sulphate). Glycerin and ox gall both act as softening agents on hard fecal masses and by their irritating effect on the mucous lining tend to cause peristalsis and evacuation. The amount ordered (usually from two to four drams of glycerin or ox gall) may be added to a soapsuds enema or may be given in a small amount of warm water or normal saline solution and followed in one hour by a soapsuds enema.

The *saline cathartics,* Rochelle and Epsom Salts, may be given in a dilute or concentrated form. From four to six ounces of Rochelle Salts or from one-half to four ounces of Magnesium Sulphate are the usual amounts prescribed for rectal injections. To prepare the solution the amount ordered is added to sufficient hot water to dissolve the salts thoroughly. When given in this concentrated form the concentration of salts in the intestines is greater than that in the blood and tissues. Fluid is, therefore, drawn from the blood and tissues by osmosis in order to dilute the salts in the intestines and render the concentration equal. The resulting accumulation of fluid in the intestines causes pressure which induces peristalsis and free evacuations.

The saline cathartics are sometimes given in dilute form by adding the amount ordered, first thoroughly dissolved in hot water, to a soapsuds enema. When given in this dilute form the concentration of salts in the intestines is less than that in the blood and tissues, the salts are not absorbed but they prevent the absorption of the water so that the intestines become distended with fluid causing pressure, peristalsis and evacuation.

Rectal injections of the saline cathartics are particularly valuable in nephritis and some cardiac conditions when there is an accumulation of fluid in the tissues (edema).

4. *Normal Saline Enemata.*—A rectal injection of normal saline has the same cleansing effect on the mucous lining of the intestines as a throat gargle or irrigation with the same solution has on an inflamed throat. It removes mucus and pus and in the intestines dilutes and removes the poisonous products of putrefaction.

A normal saline solution when used for a rectal injection is prepared by adding 1 dram of salt to a pint of water. While these proportions are accurate enough when the solution is given by rectum it is not, strictly speaking, normal saline (9-10 of 1 per cent.) and would never be used when the solution is to be injected directly into the tissues (hypodermoclysis) or into the bloodstream (intravenous). When the treatment is given for its cleansing effect two pints of the solution are generally used. It is not to be retained.

5. *Carminative Enemata* are given to prevent or relieve distention. A carminative enema is an injection into the rectum of a solution containing drugs which have a carminative action. Such drugs by their antiseptic action prevent the formation of gases and by their irritant action on the nerve endings in the lining of the intestines, cause the contraction of their muscular walls (reflex action) and the expulsion of the gas causing the distention. Turpentine, asafetida, and alum are the drugs commonly used as in the following:

(a) *Turpentine.*—Four drams of turpentine may be added to two pints of soapsuds. The turpentine must be very thoroughly mixed and dissolved. This enema is not to be retained.

(b) *Turpentine and Oil.*—One-half to one ounce of turpentine may be mixed with six to eight ounces of olive oil. Turpentine is very irritating. The oil is used to dilute and lessen the irritation and danger of blistering. To prepare the enema the oil is first heated to about 110° F., the turpentine is then added and thoroughly mixed with the oil. This enema should be retained if possible from one-half to one hour. A soapsuds enema is then given.

(c) *Alum.*—Two ounces of alum dissolved in two pints of hot water. The enema is not to be retained.

(d) *Compound Medicated.*—Turpentine four drams, asafetida two drams, ox gall four drams, glycerin four ounces with two pints of soapsuds. To prepare the enema first mix the ox gall, if in crystals, with the turpentine, otherwise it will not dissolve. Also see that the utensils used are dry. Add the other ingredients and thoroughly mix with the soapsuds. The temperature of the solution when given should be 116° to 118° F.

(e) *Milk and Molasses.*—To prepare the enema, heat eight ounces of milk. To this add slowly eight ounces of molasses, stirring it in well. The temperature of the solution when given should be from 100° to 105° F. The carminative action is due to the fact that the sugar in the molasses is irritating to the lining of the intestines and the sugar and milk together produce gas which distends the intestines, causes pressure, peristalsis and evacuation.

Rectal injections for a carminative effect are usually given as hot as the patient can stand, 116° to 118° F., the heat being a powerful stimulus to peristalsis and expulsion of the gas. The injections should be given slowly and when small amounts are used, the patient should be encouraged to retain it for from ten to thirty minutes. As the treatment is given for the relief of distention, note and chart particularly the amount of flatus expelled in the return.

Local Remedial Applications

The following enemata are used when it is desired to make direct application to the diseased wall of the intestine.

An Anthelmintic Enema is an injection of a solution containing a drug capable of destroying or expelling worms from the intestines.

Pin-, thread-, or seat-worms may be destroyed and expelled by repeated injections of the infusion of quassia. About one-half pint is the amount usually used and the treatment is given daily until the worms are destroyed. Before giving the treatment the bowel should be cleansed by a soapsuds enema so that the solution may come in direct contact with the worms and the lining of the intestines. Quassia is an astringent. It contracts the tissues and blood vessels, checks bleeding and inflammation, lessens the amount of mucus in which the worms may lodge, shrivels and destroys the worms. The patient should be encouraged to retain the solution for from fifteen to thirty minutes.

Other *astringents* such as tannic acid or alum (30 grains in one pint of water) are sometimes used to destroy worms, or germs in dysentery or cholera, etc., and to relieve inflammation. They are usually given in the form of rectal or colon irrigations, the solution being allowed to run in very slowly and gently and to return immediately in order to avoid distention, pain and irritation of the inflamed wall.

An Emollient Enema is an injection of some bland solution for the purpose of checking diarrhea or soothing and relieving irritation of an inflamed mucous membrane. Starch is commonly used. To prepare the solution, dissolve one teaspoonful of starch in a little cold water making a smooth paste. Then add slowly six ounces of boiling water, stirring constantly. Allow the solution to cool to 105° or 106° F. and give with a catheter. The enema is to be retained. Laudanum (tincture of opium) is sometimes added to a starch enema to check secretions and peristalsis and to relieve pain and local irritation in diarrhea. When ordered, laudanum should be added just before the enema is given. Be sure that the full amount ordered is given. To insure this sometimes the drug is added to a small portion of the starch. After this is injected the remaining solution is given.

Enemata Given For a General Systemic Effect

When for any reason it is impossible or undesirable to give fluids, medications or nourishment by mouth or when it is necessary to supplement the amount given, they may be administered by rectum.

The purpose of the treatment may be to act as a general stimulant in shock or collapse; to supply sedative drugs to prevent or relieve convulsions; to supply fluid to the body and relieve thirst following a critical operation or severe hemorrhage; or to supply nourishment in the hope that a sufficient amount may be absorbed to sustain the life of the patient. It will be seen that patients receiving such treatments are frequently in a critical condition requiring the most expert care. They are, therefore, usually assigned to an older nurse and will be discussed later.

The Procedure.—*Factors Which Govern the Method.*—When giving a rectal injection it is important to remember the following anatomical, physical, and physiological factors:

The word rectum means straight. The rectum in the infant is straight and vertical. In the adult it is a curved tube about 5 to 8 inches long, beginning at the anus, extending upward and forward into the pelvis to the tip of the coccyx, then curving upward and backward, following the curve of the coccyx and sacrum upon which it lies. It then curves to the left to form the beginning of the sigmoid loop or colon leading to the descending colon. *A rectal tube cannot be passed beyond the sigmoid loop under normal conditions.* The upper pelvic portion of the rectum is very distensible—large enough to contain the entire hand (Woolsey), so that large masses of feces may accumulate here, and as the water is absorbed these harden and become difficult to remove or expel.

The rectum is guarded by two sphincter muscles and, in health, is tightly closed.

About three inches up from the anus the mucous lining of the rectum extends out into the canal, forming three folds, acting as valves or ledges (Houston's folds or valves), which probably support the feces and so relieve strain on the sphincters of the anus. These are more prominent when the rectum is distended with feces, etc. They must be remembered when passing the rectal tube because they may interfere with its passage, especially when the rectum is empty. *Never force a passage.* Insert the rectal tube within the rectum, then allow fluid to flow in, and as the rectum becomes distended the folds no longer impede and the tube then may be inserted further.

The rectum is also richly supplied with blood vessels, the blood returning by the hemorrhoidal veins which have no valves. Chronic constipation, with the accumulation of feces, causes pressure on these veins, which is increased by straining at stool, and may cause congestion forming hemorrhoids or piles. These may be internal or external, may become inflamed and bleed easily. There are many nerves at the anus so that it is always very sensitive. Hemorrhoids are very painful and when these are present, unusual care must be taken when inserting a rectal tube.

The patient's mental reaction to a treatment of this kind, especially if given for the first time, must be remembered, and her feelings of natural reserve and sensitiveness respected. Even though the patient should be unfortunate enough to lack these natural feelings, the nurse owes it to herself and the standards she upholds to see that the patient and the procedure are screened from view, and that only the necessary exposure is made. This applies equally to public and private patients. The nature and benefits of the treatment should be explained.

Method of Giving an Enema.—The *articles required* for the treatment (depending upon the technique used) will be a bath blanket, a basin, a funnel with a rectal tube attached, a pitcher with the solution, vaseline, a rubber and sheet to protect the bed, a bedpan, a basin of water, paper and cotton pledgets to cleanse and dry the patient, and a paper bag. Sometimes when a large amount of solution is to be injected, instead of pouring it from a pitcher into a funnel, it is allowed to run from a douche can through a long piece of rubber tubing (about 3 feet long) attached to the can, provided with a clamp, and connected by a glass connecting tip to a rectal tube. The can hangs from an irrigating pole.

The *bed* should be protected and the draping and bedclothes arranged so as to avoid exposure of the patient and possible contamination or lingering odors.

Position of the Patient.—The patient should be drawn to the side of the bed, turned on her *left* side (when possible), so that the fluid, by gravity, will flow into the sigmoid and descending colon. The knees should be flexed, the right slightly more than the left to relax the abdominal muscles. The position is also one of ease and comfort. In some post-operative cases and where the sphincters are relaxed or the perineum or sphincters torn it may be necessary to give the treatment with the patient in the dorsal, recumbent position. When the sphincters are relaxed or torn so that it is impossible for the patient to retain the solution even for a few minutes it will be necessary to first place the bedpan under the patient. This is a most uncomfortable and undesirable position and should never be used in any other cases.

Before inserting the tube it should be oiled with vaseline and the water should be allowed to run through to warm the tubing and expel the air. Air introduced may cause colic. Insert the rectal tube just within the anus, allow fluid to run in, then insert it for about six inches. If it is desired to have the patient retain the solution in order to soften the feces, or if it is necessary to inject a large amount, give it very slowly and evenly so as not to excite the bowel to contraction. When given quickly the sudden distention and irritation causes peristalsis and immediate evacuation. If given too cold or too hot, the same results. While the fluid is flowing in, see that the funnel or irrigating can does not become empty, thus allowing entrance of air. If the patient complains of pain, pinch the tube and stop the flow for a minute. If the fluid does not run in freely, moving the tube slightly sometimes helps, or it may have to be removed and cleansed, if clogged.

After the desired amount has been given, if the enema is not to be retained, pinch the tube and remove it gently. Then turn the patient on her back, at the same time place the bedpan under her being sure that it is straight and in the center to avoid an overflow. The bedpan should be warm. Arrange the draping so as to protect the bed from fluid and fecal material apt to be scattered by the forcible expulsion of flatus. After the enema is expelled, remove and cover the bedpan; turn the patient on her side, cleanse and dry the parts thoroughly. Remove the rubber, etc., and rearrange the clothing. Clear away the articles, cleanse, and put in their proper places.

This treatment may be very exhausting for weak patients. They should be closely watched and guarded from all unnecessary exertion or discomfort.

Chart the results—whether the return was satisfactory, whether it was fluid or contained small, hard masses, the amount of flatus and the presence of any other abnormality.

If the patient cannot expel the enema, report it to the head-nurse, reinsert the rectal tube, placing the end in a bedpan. Retention of a soapsuds enema is apt to occur when the patient has been deprived of fluid or the body has lost much fluid. The solution injected is then absorbed to relieve thirst and supply fluid of which the tissues are in need.

Measures Used to Aid Retention.—When it is desired that an enema be retained it is necessary to avoid all stimuli, either mental or physical, which might excite peristalsis in the intestines. First reassure the patient, see that he is mentally at ease and avoid during the treatment anything which might cause excitement, anxiety or distress. Avoid unnecessary exposure, pain or discomfort and anxiety as to the danger of expelling the enema and soiling the bed. The patient should be comfortable, all his wants attended to so that he may be quiet and undisturbed after the treatment. The amount of solution used should be small, it should be injected very slowly and gently through a rubber catheter, well lubricated and inserted very gently. Special care should be taken after operations. The catheter should not be lubricated with glycerin as it excites peristalsis. The tube should be inserted as high as possible, that is about 6 to 8 inches. If the temperature of the solution is near that of the rectum there is less danger of expulsion. After the injection is made remove the tube very gently or it may be clamped off and allowed to remain inserted to prevent expulsion. Pressure to the anus with a folded towel may be applied for a few moments until excitement of the intestines caused by the treatment has subsided.

The Care of Rectal Tubes.—Rectal tubes must be thoroughly cleansed both inside and out, first with cold water, then with warm soapy water. The inside is cleansed by allowing the water to run through them from the hole in the tip to the outlet. They are then boiled for three minutes in water containing a little salt to prevent softening of the rubber. Then allow to drain, dry and put away in the proper place. After an oil enema the catheter or rectal tube should be cleansed immediately as oil destroys rubber.

Hard rubber rectal tips are occasionally used. *Hard rubber* should never be sterilized by boiling as it is ruined by the heat. It is sterilized by immersion in a disinfectant solution such as carbolic, cresol, or formalin. This applies to hard rubber whether used in rectal tips, douche tips, atomizers or other articles.

Rectal injections, even the simple cleansing enema, should only be used when ordered by a doctor. Their prolonged use develops into a custom, paralyzes the muscles and makes artificial means of evacuation a necessity.

THE STOOLS OF A NORMAL INFANT

When on duty in the Infants' Ward, a young student nurse may be required to change the soiled diapers of infants not acutely ill. When doing so it is important that she should note the character and number of stools passed during the day.

The Number of Stools.—A normal breast-fed infant should have two or three stools each day during the first week. It is very important for the nurse to watch the number and character of the stools during this period. An absence of bowel movement may be due to some congenital malformation of the anus, rectum, or colon, which should have the immediate attention of a surgeon. After the first month there are usually two stools each day, but there should be at least one.

A normal artificially fed infant should have at least one stool a day.

The Character of the Stool.—This is of even greater importance than the number. The stool of a breast-fed infant is orange-yellow in color, soft, smooth, mealy or stringy in consistency, having a pungent odor and acid reaction.

The stool of an artificially fed infant changes in appearance with the food given. For instance, when nothing but milk is given, the stool is lemon-yellow in color; when malt, starch or beef-juice is given it is brown in color. The consistency is salve-like.

The character of the stool is an important indication of whether the infant is getting the proper feeding or not. For instance, the presence of large, hard curds in the stool indicates usually *too much protein* in the diet. The stools may be otherwise normal or they may be frequent in number, large and watery in character, alkaline in reaction, and either green or brown in color.

The presence of soft curds in stools which are large, dry, shiny and gray indicates *too much fat* in the diet.

Stools which are watery and green in color, highly acid and irritating to the tissues indicate *too much sugar* in the diet.

If there is any abnormality in the color, odor or consistency of the stool, the nurse should save it for the inspection of the headnurse, who will show it to the doctor if advisable.

The number and character of the stools are recorded on the chart.

The Method of Changing the Infant's Diaper.—Infants should never be left with soiled or wet diapers. Damp clothing about an infant always predisposes to chilling and cold.

In changing an infant's diaper some of the important things to remember are as follows:

The room should be warm. The nurse should be properly protected. After removing the soiled diaper the buttocks and genitals are carefully cleansed, dried, and powdered. Olive oil is used for cleansing because it is soothing and helps to keep the skin in good condition. Warm water and soap are used for cleansing only when absolutely necessary because frequent washing is apt to make the parts tender. If the skin is irritated and red, the nurse should report this to the headnurse. A soothing ointment (such as a mixture of Lassar's paste and olive oil) may be applied. If the buttocks are very sore, the treatment frequently used is to expose the buttocks to heat rays from an electric light suspended from a cradle in the bed.

In putting on the clean diaper the important things to remember are to select a diaper suitable in size to the size of the infant, to fold it properly so that it may be securely fastened in place and serve the purpose for which it is applied without causing pressure or interfering with the natural position, freedom of movement, and growth of the infant's legs. The ends of the diaper should be fastened and tucked in neatly and smoothly. The folds should be flat and smooth, never bulky. Safety pins only should be used to fasten the diaper. A sufficient number should be used to securely fasten it and prevent the escape of feces. The pins must be in good condition and secured so that they cannot come unfastened and injure the child.

Changing a diaper is a procedure which requires considerable skill. Babies are rather difficult to handle because they are so small, weak and helpless or very restless, and the change must be made quickly and without unnecessary exposure. As in all other procedures skill will only come with practice, patience, thought and care.

Formation of Regular Habits.—One of the nurse's most important duties is to train an infant in the habit of passing the stool and voiding urine at regular intervals and at a definite time. As explained previously, this regularity is of the utmost importance in the prevention of constipation, and all the ills which follow. Training cannot begin too early. A habit will be formed which may last throughout life and be of the greatest benefit. If the training is begun early the habit of regularity in defecation may be formed by the end of the second or third month and regularity of voiding urine at the end of the first year.

Dr. Holt gives the following directions: "A small chamber, about the size of a pint bowl, is placed between the nurse's knees, and upon this the infant is held, its back being against the nurse's chest and its body firmly supported. This should be done twice a day, after the morning and afternoon feedings, and always at the same hour. At first there may be necessary some local irritation, like that produced by tickling the anus or introducing just inside the rectum a small cone of oiled paper or a piece of soap, as a suggestion of the purpose for which the baby is placed upon the chamber; but in a surprisingly short time the position is all that is required. With most infants, after a few weeks the bowels will move as soon as the infant is placed on the chamber."

Method of Giving an Enema to an Infant or Young Child.—In giving a cleansing enema to an infant, provision must be made for the immediate return of the solution as the infant will not retain it. The solution used may be a mild soapsuds or normal salt solution. A catheter is used instead of a rectal tube and an irrigating can, rubber tubing and connecting tip are usually used instead of the funnel. The irrigating can should not be more than one foot above the child.

To give the irrigation the nurse protects herself with a rubber apron which is allowed to hang into a receptacle on the floor. The infant lies on her lap, either on its back or side, with its legs flexed on the abdomen and its buttocks resting at the edge of the nurse's knees. The child may be held securely and firmly in this position. Restraint should not be used if possible to avoid it. Try to calm fear, nervousness or struggling, if present, before beginning the treatment as they interfere with attaining the results desired. Considerable flatus may be expelled so that it is wise to arrange the draping so as to avoid soiling of surrounding articles.

This treatment must be given with extreme care and is usually assigned only to an experienced nurse. All the precautions to be observed in giving treatments to adults are of even greater importance when the treatment is given to infants or children.

CHAPTER XII

THE MAINTENANCE OF HEALTH

THE PREVENTION AND CURE OF DISEASE
BY
THE ELIMINATION OF BODY WASTES (Continued)

THE ELIMINATION OF WASTE PRODUCTS BY THE KIDNEYS

A nurse should note, particularly, the amount of urine voided in twenty-four hours, the amount at each voiding, whether voidings are frequent or not, whether any pain, discomfort or difficulty is felt in passage, and the color, odor, and transparency of the urine.

The Amount.—The normal amount of urine voided by an adult varies from 1000 to 1500 c.c.; by a child (two to fourteen years) from 450 to 1500 c.c. A normal adult voids from 8 to 10 ounces every 4 to 8 hours. Patients should be given the bedpan or urinal at regular hours, usually before meals and before bedtime.

The amount of urine voided may be greatly increased temporarily by drinking a large amount of fluids, by nervousness and excitement, by exercise, by cold baths and by the action of diuretics. In winter urine is usually voided more freely because less water and waste products are eliminated by perspiration. The amount is usually increased in hysteria, during a crisis in an acute disease, in chronic nephritis, in diabetes mellitus and in diabetes insipidus. In an acute disease the temperature is high, the skin is usually dry, and the kidneys do not eliminate freely; during the crisis the temperature falls; all the avenues by which the body loses heat are opened so that the patient usually perspires freely and voids a large amount of urine. In chronic nephritis the diseased kidney has difficulty in eliminating the solid waste products so it eliminates a small amount of solids, and, to dilute and make them less irritating, it at the same time eliminates a very large amount of water; the urine will be pale and of a low specific gravity. In diabetes mellitus the tissues are unable to burn sugar so it accumulates in the tissues and in the blood. The patient is very thirsty and drinks quantities of water because the body must have a large amount of water to dissolve or dilute the sugar and eliminate it through the kidneys. The urine will be pale in color, but the specific gravity will be high because although there is a large amount of water there is also a large amount of solids due to the sugar eliminated in the urine.

The voiding of a large amount of urine is called *polyuria.*

The amount of urine voided may be greatly decreased by drinking small amounts of fluids, by the loss of body fluids by other avenues—by free perspiration, as in the summer, by vomiting, diarrhea, a severe hemorrhage, and by the action of drugs, such as opium, which checks the secretion of urine. The secretion may also be checked in poisoning from such drugs as bichloride of mercury, which so irritates the kidney cells as the body tries to eliminate it as to completely or partially cause loss of function. The toxins formed in all the acute diseases, such as pneumonia, diphtheria, and scarlet fever, have the same injurious effect on the kidneys. In acute diseases the voiding of a large amount of urine is usually a favorable symptom. In acute nephritis and in heart diseases which cause poor circulation in the kidneys, the amount of urine voided may be very small. When the amount of urine voided is scanty, the condition is called *oliguria.* When there is a total absence or a marked deficiency the condition is called *anuria.*

In diseases marked by either an increase or decrease in the amount of urine voided, it must be carefully measured and accurately recorded on the chart.

Anuria or failure to void urine may be due either to *retention* or to *suppression of urine.* It is very important to know to which anuria is due for the effect on the body and the treatment required differ greatly.

Retention of Urine.—Retention means that the urine secreted by the kidneys is retained in the bladder.

Retention with overflow sometimes occurs, that is, some urine is voided, but the bladder is not emptied and the patient complains of a feeling of fulness and discomfort. The distended bladder may sometimes be felt.

The symptoms of retention are (1) failure to void; (2) a feeling of fulness and discomfort, sometimes amounting to severe pain; (3) a distended bladder.

Any of the above symptoms should be noted by the nurse and immediately reported. When the bladder contains urine but the act of voiding does not occur, means must be taken to cause its expulsion or to remove it by artificial means. If simple nursing measures fail to relieve the retention, catheterization must be resorted to. This treatment is accompanied by a considerable risk to the patient and should only be carried out by a nurse with experience, knowledge, and skill, so will be discussed in a later chapter.

Before catheterizing a patient or even reporting that she is unable to void, every nursing measure should be tried to cause the bladder to empty itself in a normal way: The measure of a good nurse lies in her ability to use her science and art to restore her patient to normal by nursing measures which render drugs and treatments (which may possibly do harm) unnecessary.

Nursing Measures to Cause the Patient to Void.—To use nursing measures to restore the patient (or the functions of the bladder) to normal, intelligently, we must recall what this normal function consists in and find out what the interference may be. Normally, the urine passes drop by drop from the ureter into the bladder, where it is stored until about eight to ten ounces have collected. Under normal conditions this causes a desire to expel it. The nerve endings in the lining of the bladder are irritated or stimulated by the pressure of the accumulated urine and this message of pressure, irritation, or of something hurting or injuring, is carried along nerve fibers to the center in the sacral region of the spinal cord which controls the bladder. This center sends a message back along other nerve fibers to nerve endings in the muscular wall of the bladder which causes them to contract and expel or force out the irritating substance. This is called a reflex act and the act is called micturition or voiding. It is only partially under our control for the cells in the spinal cord communicate with and to a certain extent may be controlled or greatly influenced by certain cells or centers in the brain. So failure to void may be due to any one of these factors: (1) The nerve endings in the bladder may be dull or insensitive as from indolence and failure to respond. (2) The nerve centers in the cord may be injured, depressed or stunned so that they fail to recognize, receive or send out any messages. This may be due to drugs such as alcohol, morphine or ether in a general anesthetic or it may be due to shock following an injury or operations on the pelvic organs with more or less exposure and injury to the bladder; or it may be due to the mental condition—depression, worry and painful emotions and it may also be due to physical pain. (3) Nervousness may cause a spasmodic contraction of the urethra, making it impossible for the bladder to expel the urine. (4) The muscles of the bladder may have lost their tone from old age, anemia, or from a greatly distended bladder when, for instance, circumstances have prevented the bladder from relieving itself for a long time. The muscles may also be cramped or partially paralyzed by exposure to cold as during a prolonged operation.

The following nursing measures may help the patient to void:

(1) Try to relieve any mental distress present—cheer and reassure the patient, remove the cause of nervousness and, if possible, find out what is the cause of worry if present. Give the patient something else to think about. (2) Remove any physical pain or discomfort. (3) See that the patient is not kept waiting so long for the bedpan that the desire to void is lost. See that the bedpan is given warm and at regular intervals to encourage micturition—this reflex act, or stimulus and response. (4) Stimulate the reflex by suggestion which is a powerful mental stimulus—by the sound of running water—a tap left running

nearby or water poured from one pitcher to another or by pouring hot water over the vulva into a warm bedpan placed under the patient. Sometimes the suggestion that catheterization will be necessary acts as a powerful stimulus. (5) Stimulate the nerve endings in the bladder by drinking freely large amounts of water so increasing the elimination and pressure in the bladder. (6) Stimulate the muscles to contract by the application of heat—a warm bedpan, pouring hot water over the vulva, applying hot fomentations or a hot water bag over the lower abdomen (a doctor's order will be necessary), and by keeping the feet and body warm. (7) Stimulate the circulation and contraction of the muscles by gentle massage over the lower abdomen if permitted. (8) Failure to void is often due to the patient's unnatural position. If allowed to sit up she may have no difficulty. Frequently even after operations the surgeon will prefer to allow the patient to sit up on the bedpan (securely supported by the nurse) rather than run the risk of catheterization. In some cases I have known the surgeon even to allow the patient to sit up with her feet resting on a chair at the side of the bed.

Suppression of Urine.—Suppression means that the kidneys are no longer able to do their work. This is a very grave condition. The waste products circulating in the blood, which normally the body eliminated through the kidneys, find this outlet or means of escape cut off, so that they are suppressed, held back, and denied a passage. They have traveled a long way, coming from every cell in the body, only to find, as it were, when they reach the kidneys, the doors closed, and, let us suppose, a sign which reads "Failed" or "Shop closed for repairs." The body must find another means of getting rid of them. Some waste will be eliminated by the bowels and some by the skin, but the skin and bowels combined cannot do the work of the kidneys entirely, so that these waste products accumulate in the body and soon give rise to very serious symptoms of distress and disease. The symptoms of *retention* of urine are largely *local,* that is, confined to the region of the bladder, but with *suppression* of urine, the symptoms are *general,* for there is probably not a cell in the body which is not injured and hampered in its work.

The symptoms of suppression are dizziness, nausea, headache, dimness of vision or seeing bright spots before the eyes, puffiness under the eyes, or a general swelling. A very small amount of urine and in severe cases no urine will be voided. In suppression when a catheter is inserted into the bladder no urine is obtained, because there is none there, whereas in retention the urine will immediately start to flow.

The treatment for suppression is (1) to encourage the elimination of waste products through the skin and bowels by hot packs and colon irrigations; (2) to rest and relieve the kidneys by careful regulation of the diet; (3) to give "forced fluids," so as to dilute the waste products and aid in their elimination; (4) to apply local relief to the region of the kidneys by "cupping" and "stupes"; (5) to stimulate the kidneys by diuretics and colon irrigations.

Report immediately any failure on the part of the patient to void the normal amount of urine.

The Transparency of Urine.—Normal urine is always clear and transparent; on standing nothing but a delicate floating cloud is seen in the center.

Normal urine is acid in reaction and always contains waste products in the form of phosphates which are held in solution by the acid medium. Under certain conditions (due to carbohydrate diet, etc.) the urine may become alkaline so that the phosphates are no longer held in solution, but are precipitated out, making the urine very cloudy and forming a sediment on standing. Normal urine on standing becomes alkaline and cloudy because normal waste products in it (the urea) are decomposed by bacteria into its original constituents, setting free ammonia which is highly alkaline. This will cause the phosphates to be precipitated. People are sometimes needlessly alarmed, thinking they have "kidney trouble" when this urine, on standing, becomes cloudy. Adding a little acid to the urine will determine whether the "cloudiness" is due to phosphates (which are normal in urine) or not; if to phosphates, the cloud will disappear.

People are also sometimes needlessly alarmed by a thick, turbid urine and a brick red sediment on standing. This sediment consists of urates and uric acid crystals, normal waste products in the urine. Urine when voided is warm and this heat keeps the urates, etc., in solution, so that the urine looks quite clear. When cooled, particularly if concentrated, they are no longer held in solution. To test the urine heat it; if the cloud or sediment is due to urates it will disappear.

When a cloud or sediment however can neither be removed by adding acid or by heating, but rather becomes coarse on heating, it is always due to abnormal substances—albumin, pus, blood, epithelial cells or casts—which indicate disease of some part of the urinary tract. The presence of albumin, pus, blood or epithelial cells may indicate disease of the bladder (cystitis), or of the kidneys, but the presence of casts always indicates disease of the kidneys.

The Color of Urine.—The color of urine depends upon the amount and kind of pigment, the concentration of the urine, the amount and kind of solids, decomposition of the solids in it, the presence of abnormal constituents, and the action of various drugs.

The pigments may be increased or decreased—increased urobilin (the chief coloring matter in urine, derived from bile, which in turn derives its coloring from hemoglobin from the wornout and decomposed red blood cells) is present in all febrile conditions and makes the urine *dark;* concentrated urine is dark while dilute urine is *pale;* very dark, *smoky* urine may be due to the presence of blood or poisoning from carbolic acid; increased urates give a *brick-red color;* bile pigments give a *greenish-yellow color;* decomposition of pigments may give a *pinkish color;* the presence of pus or chyle gives a *whitish* or *milky appearance*—chyle is present in filariasis; the action of drugs—such as rhubarb and senna—gives a *bright orange color;* methylene blue gives a *blue-green color;* iodoform a *dark greenish color.*

The color of urine is not of any great importance in diagnosis.

The **odor of urine** is said to be characteristic, that is, it is like nothing else—the odor of urine about a patient is unmistakable. It is due to various volatile, aromatic substances in it. As previously stated, when urine is allowed to stand its urea decomposes, liberating ammonia; decomposed urine therefore has the odor of ammonia. Where freshly voided urine has this odor it shows that decomposition has already taken place in the bladder; this indicates cystitis. In diabetes the urine may have a sweetish odor due to the presence of acetone. The odor of ammonia or of acetone should, therefore, always be reported, as they indicate disease. Various drugs and also various articles in the diet also alter the odor of urine.

THE COLLECTION OF SPECIMENS OF URINE

The way in which the kidneys are working and the waste products contained in the urine have such an important bearing on the patient's condition, the diagnosis and treatment, that a *"routine"* specimen of urine is sent to the laboratory for examination, that is, it is an understood rule that on the admission (or on the following morning) of each patient, a specimen of urine will be sent for examination.

A "Routine" Specimen.—A "routine" specimen is the urine passed in one voiding. The whole amount voided may be sent for examination, but only four ounces are necessary for the tests in a routine examination. Food and exercise cause a temporary change in the urine, therefore the best time to collect a routine specimen is before breakfast.

It will be examined for:

1. *Its Reaction,* that is, whether it is acid or alkaline. Normal urine is acid because, on a mixed or average diet, more foods are eaten which yield acid waste products as a result of their metabolism than foods which yield alkaline. The reaction may vary somewhat, therefore, with the diet.

2. *The Specific Gravity,* which depends upon the amount of solids in the urine in proportion to the amount of water. It is based upon water as a standard—one liter of water at a certain temperature weighs 1000 grams. Urine is heavier than water, because of the solids contained in it. The specific gravity of normal urine varies from 1.012 to 1.024 for an adult, and for a child from 1.008 to 1.020. In disease it may be as low as 1.002 (showing that the kidneys are eliminating a smaller amount of

solid waste in proportion to the amount of water), or it may be as high as 1.060, showing the presence of a large amount of solids.

3. *The Presence of Epithelial Cells and Leucocytes,* or white blood cells. The kidney tubules, which secrete the urine, the ureter and the bladder are lined with epithelial cells. These are being constantly worn out and shed in the urine (just as the cells of the outer skin), so that there will always be a few epithelial cells in the urine. *Many epithelial cells,* however, indicate increased destruction of these cells and so indicates disease of the lining of the kidney tubules, the ureter or the bladder. Where there is disease—irritation or inflammation—there will always be an increased number of leucocytes whose duty it is to help, to protect and to repair the damage.

4. *The Presence of Albumin.*—Albumin is a body protein which circulates in the blood to supply the cells and which forms a necessary constituent of all body cells. Normally, in the urine there is a slight or "faint" trace of albumin, but too small an amount to be detected by the ordinary tests used. The products of inflammation—many epithelial cells, leucocytes or pus—will cause a "marked trace" of albumin in the urine, so that in inflammation of any part of the urinary tract—kidneys, ureter, or bladder,—albumin will be present in the urine. Some people are said to have a functional disturbance of the kidneys, that is, their urine will contain albumin after a cold bath, excessive exercise, or a high protein diet, without having inflammation of the kidneys. The presence of a "marked trace" of albumin in the urine, however, is generally accepted as an indication of nephritis, which is a very serious disease, important to recognize in its early stages. So generally is this accepted that no life insurance policy is ever granted without testing the urine for albumin. If a "marked trace" of albumin is found the policy is not granted.

Albumin in the urine may result from the following conditions:

(a) Acute nephritis, in which the amount of albumin may be so great that when the urine is heated it forms a jelly—albumin coagulates when heated like the white of egg, which is largely albumin.

(b) In febrile conditions, as in scarlet fever and diphtheria, etc. The increased body temperature, the increased destruction of body tissues, the toxins produced by the bacteria all have a very injurious effect upon the kidneys and may themselves produce an acute nephritis. Nephritis is one of the dreaded complications to be guarded against in these diseases.

(c) Poisoning by ether, bichloride of mercury, carbolic acid, lead and cantharides, etc. These are all irritating, poisonous and destructive to the body cells, and in whatever way taken into the body must be eliminated by the kidneys. They not only increase the work of the kidneys by increasing the waste products to be eliminated, but in their passage through the kidneys into the urine they irritate and destroy the secreting cells.

(d) An uncompensated or failing heart. The blood pressure will be low, the circulation in the kidneys will be poor, so that the kidney cells will be very poorly nourished. The life and function of the cells and the normal secretion of urine depend upon the free circulation of blood through the kidneys.

(e) In all severe cases of anemia. The poor quality of the blood causes degenerative changes in all the organs of the body, including the kidneys.

(f) In pregnancy.—Nurses often do routine examinations in prenatal cases to detect such signs.

5. *The Presence of Sugar or Glucose.*—Normally there is a very faint trace of sugar in the urine. Eating a large amount of candy may cause temporarily a marked increase of sugar to appear in the urine in a perfectly healthy person. With no such cause, however, the presence of sugar indicates that the patient is suffering from a very serious disease—diabetes. In this disease the body cells are unable to burn the normal amount of sugar supplied them as fuel, and so are unable or have difficulty in producing the necessary heat and energy for the body processes. As the sugar eaten is of no use to the body, and the blood will only carry a certain amount, Nature gets rid of it by elimination, and as glucose readily passes through any membrane, it overflows from the blood into the urine. In severe cases of diabetes the amount of sugar in the urine may rise as high as 10 per cent.

The presence of sugar in the urine does not indicate disease of the kidneys. Students frequently have the impression, that because the presence of sugar in the urine is abnormal, the kidneys must be diseased. This is not the case, for, as stated above, glucose will readily pass through any membrane, either within or without the body. However, as sugar is irritating to the tissues, the constant passage of sugar through the kidneys into the urine may set up an inflammation so that nephritis may complicate diabetes.

A "Pre-operative" Specimen.—A "pre-operative" specimen of urine is one collected and examined in the morning previous to the operation, if the patient is to be given ether or chloroform as a general anesthesia. The surgeon will not operate until a report of the examination assures him that the kidneys are normal and also that the patient is not suffering from diabetes. The urine is therefore particularly examined for albumin (which indicates nephritis) and sugar (which indicates diabetes). As previously stated, ether and chloroform are very irritating to the kidney cells, so that if the patient already has even a mild nephritis any additional irritation may set up an acute nephritis from which he may not recover.

In diabetes there is an increased amount of sugar in the blood

This increased amount of sugar in the blood so interferes with the metabolism of the cells that the wound may not heal.

A "Post-operative" Specimen.—A "post-operative" specimen is sent for examination to find out the effect of the anesthetic on the kidneys. A faint trace of albumin is almost always present, showing slight irritation of the kidney cells due to the ether.

The Method of Sending Urine Specimens to the Laboratory.—The above specimens, specimens of one voiding or at least four or five ounces, should be sent to the laboratory in a clean bottle, securely corked with non-absorbent cotton, and to which a tag is attached on which is clearly marked the date and time collected, the name of the ward, the patient's name, and for what the urine is to be examined. The bedpan or other receptacle used must be scrupulously clean.

When a routine specimen of urine is required from a patient who is menstruating, the vagina should be plugged with cotton to prevent the blood from contaminating the urine. Otherwise the result of the examination would be most misleading. It is not necessary to catheterize the patient.

A Twenty-four-Hour Specimen of Urine.—*Its Value and Importance.*—If the routine specimen of urine on examination shows the presence of abnormal constituents or if the disease from which the patient is suffering makes a more thorough examination desirable, *all the urine secreted by the kidneys* during a period of twenty-four hours is measured (and the amount charted), saved and sent to the laboratory for examination. All the urine voided while the patient is in the hospital or as long as desired may be saved in this way for examination. With a specimen of one voiding, it is possible only to make a *qualitative analysis,* that is, to find out what *constituents or wastes* are present, but not a *quantitative analysis,* that is, to find out how much of each waste product is present. With a twenty-four-hour specimen—the total amount secreted by the kidneys—it is possible to estimate not only what wastes the kidneys are eliminating, but the quantity of each and so to form an accurate idea of not only how the kidneys are working, but of how foods are being utilized in the body, and also of other processes of metabolism. Again as the urine is altered by diet and exercise, the only way to obtain accurate results is to examine the full amount voided during the day.

As the diagnosis, the diet, and general treatment may to a large extent be based on the findings in this examination, and also as the tests are very tedious, and involve a great deal of money and the time of chemical experts in the laboratory, it is extremely important that no mistakes should occur in collecting, saving or sending for examination, and that *all* the urine secreted by the kidneys should be examined. Otherwise the findings, the results of hours of work will not only be useless, but if used would be very misleading and lead to a faulty diagnosis and treatment.

Errors in Collecting to Be Avoided:

1. See that a large bottle is properly tagged with the date, the hours at which obtained, the name of the ward, the patient's name, the nature of the specimen and for what it is to be examined. Errors are often avoided if information on these tags is printed, not written.
2. See that by no possible error could specimens from different patients become mixed by emptying in the wrong bottle, etc. Keep your mind on your work and read the tag carefully.
3. See that the receptacle used is scrupulously clean.
4. See that the specimen bottle is scrupulously clean, properly corked with non-absorbent cotton, properly tagged, and kept in a cool place. Sometimes a preservative such as toluol (a dram) is used.
5. See that no urine is lost by spilling in the bed, or by other accident. Avoid having the patient void urine at the same time as passing a stool. Try to have them void at regular intervals and *before* passing a stool. Use two bedpans if necessary. If the patient is likely to have involuntary micturitions give the bedpan at intervals frequent enough to avoid this loss. Never empty the bedpan without finding out whether the urine is to be saved.
6. See that the amount sent for examination is the urine *secreted by the kidneys* during that period, and not that merely voided or expelled from the bladder. The examination is to find out how the kidneys are working, and not how the bladder is working. For instance, a twenty-four-hour specimen is collected from 6 A.M. of one morning (or at whatever hour designated by the doctor or rules of the ward) to 6 A.M., that is, exactly the same hour on the following morning. Now the urine voided at 6 A.M. of the first morning has been secreted by the kidneys and collected in the bladder during several previous hours—we do not know how many—and so must not be included in the twenty-four-hour specimen begun at that hour. The patient should void and empty the bladder at 6 A.M. (if that is the time for beginning), and *this urine should be thrown away*. If the bladder is now empty we know that all the urine voided up to and including 6 A.M. of the following morning must have been secreted by the kidneys. For the same reason, to make our collection complete, we must see that the patient voids, and that the bladder is emptied at 6 A.M. of the following morning, because the urine contained in the bladder at that time has been secreted by the kidneys during the period that they are under examination. Otherwise our results would be most inaccurate.
7. If by any unavoidable accident urine should be lost, make a note of this on the tag, and also on the patient's chart.

A twenty-four-hour specimen may be examined for:

1. The total *normal constituents* or waste products of metabolism. The function of the kidneys in the healthy body is to

eliminate (and therefore these are the normal constituents of urine)—(a) excess water; (b) the ashes or wastes of protein metabolism; (c) the inorganic salts not required in the body.

2. The total *abnormal constituents,* the products of incomplete or faulty metabolism and of disease.

The Ashes or Wastes of Protein Metabolism.—These include the ashes resulting from the metabolism of the excess protein food absorbed from the diet (we all eat more protein than the tissues require) and also from the breaking down of the body tissues. These wastes of protein metabolism are chiefly in the form of *urea, uric acid,* and *creatinin.*

All proteins and protein wastes contain the elements nitrogen, carbon, hydrogen, and oxygen, nitrogen being the essential element which distinguishes it from the other foods, carbohydrates and fats. Nitrogen forms 16 per cent. of the weight of the protein molecule, so that if the amount of nitrogen in the urine is ascertained the amount of protein from which it was derived can easily be estimated. As the elimination of protein wastes is one of the chief functions of the kidneys, the urine is frequently examined for the *total nitrogen* contained in it. The result not only gives the protein metabolism in the body, but the efficiency of the kidney in getting rid of the wastes. For instance, by subtracting the amount of protein (or nitrogen) eliminated in the urine from the amount of protein (nitrogenous food) given in the diet, and making allowances for the ashes resulting from the breaking down of tissue cells, the amount of protein retained in the body may be estimated: It may have been retained either for the growth and repair of the tissues or because the kidneys failed to eliminate it.

The normal daily output of nitrogen in the urine on a regular diet is about 15 grams and as nitrogen equals 16 per cent. of the weight of the protein molecule, this daily output is the waste product resulting from the metabolism of about 94 grams of protein.

When the patient is fasting, the daily output of nitrogen is 5.25 grams, which is the product resulting from the breaking down of 33 grams of body protein. This breaking down and loss are constantly going on. A very important lesson is to be gained from the knowledge of this fact which is, that, when a patient is on a fluid diet, in order to prevent this great loss of body protein or life substance, the *fluids must be nourishing,* for, they must contain protein or nitrogenous food to repair this loss and to build up the tissues. Again, the patient must have *rest and sleep and all unnecessary exertion must be avoided* in order to conserve and prevent this loss. There will be an increased loss of body protein due to the destruction of body tissues in (1) starvation with marked malnutrition; (2) pernicious anemia in which all the cells of the body are poorly nourished and practically starved; (3) carcinoma and other malignant growths—the tissues are poorly nourished and the destruction of tissues is great, one of the outstanding symptoms of carcinoma being a marked loss in weight; (4) infectious diseases,—because of the patient's loss of weight and the limited diet allowed he is forced to live on his own body tissues to produce the energy necessary to carry on life. Again, the high temperature and the toxins cause a great destruction of body tissues. Patients usually become very emaciated with infectious diseases. There will be a *decrease in the amount of nitrogen* in the urine during convalescence from disease because the body is retaining the protein to build up the broken down tissues. In all the above conditions the patient requires a diet which is highly nourishing.

The urine is frequently examined for the *total urea* which gives a fairly accurate estimate of the protein metabolism and the efficiency of the kidneys, because 85 to 90 per cent. of all the nitrogen excreted is in the form of urea. Urea is an inert substance, that is, it does not combine readily with other substances, and therefore while a waste product, it is in a form relatively harmless to the body cells. But the intermediary products of which it is composed—ammonium products resulting from the metabolism of protein—are extremely irritating and poisonous and if allowed to accumulate in the body will cause uremic poisoning, an extremely serious and often fatal condition. To prevent this the body, chiefly through the liver and also the body cells, combines and changes these poisonous products into urea which is readily eliminated by the kidneys. It was once supposed that the accumulation of urea in the body was the direct cause of uremic poisoning, but urea may be injected into the blood without causing any of the symptoms of uremic poisoning and it will quickly be eliminated in the urine.

If the results of these tests show that the metabolism of protein in the body is faulty or that the kidneys are not eliminating the protein ashes as they should, then the patient's diet will be regulated by cutting down the protein and he will be given medications and treatments to prevent the wastes from accumulating in the body. By giving a "low protein diet" the amount of protein ashes to be eliminated and therefore the work of the kidneys will be greatly lessened. They will have as little work as possible to do so that they may have a chance to rest and to turn all their attention to repairing the damage to their cells which prevents them from performing their function properly. In this way only can the diseased kidneys be restored to normal.

From the moment of her earliest experience and responsibility with patients a nurse should watch very closely the reports of the urine analysis and the regulations made in the diet, medications, and treatment even though at first they are not entirely clear to her. By degrees they will become clear, and only in this way, and by constant study and observation, can she hope to understand her patient's condition, and intelligently, and with safety to the patient, care for him.

The Inorganic Salts.—The *chlorides* (obtained from the food and eliminated in the urine) form more than all the other salts combined, so that the output of salts, and the efficiency of the kidneys in eliminating them, is tested by finding the "total chlorides" eliminated in the urine.

The normal daily output of chlorides in the urine on a regular diet is from 10 to 15 grams. If the examination of the urine shows that the kidneys are eliminating less than the normal amount and that therefore the salts are being retained in the body, the patient is usually put on a "salt-free" diet, that is, salt is entirely eliminated—butter, bread, vegetables, etc., are prepared free of salt, and no salt is allowed on the tray—in order to prevent the accumulation of salts in the body, to lessen the work of the kidneys, and to lessen the irritation of the salt passing through the diseased kidney. In nephritis the action of salt on the inflamed tissue is very irritating (just as salt on any raw, inflamed surface will smart and sting) and so aggravates the condition. The chlorides are more irritating than the other salts.

The retention of salts occurs in nephritis with edema, and in heart failure with a sluggish circulation.

Retention and Edema.—The tissues must have a certain percentage of salt (0.5 per cent.). Salts must also be in solution. If the kidneys fail to allow the salts to pass through into the urine they will accumulate in the tissues and as they must be in solution to prevent injury to the cells, and again as fluids always keep up a constant exchange until they are of the same density or osmotic pressure, the tissues will draw water from the blood to dilute the salts. All the tissue spaces between the cells will become engorged with fluid so that the tissues will be "water-logged." This condition is called edema. It begins usually in the loose tissue where there are numerous spaces as in the tissues beneath the eyes or on the back of the hands, which are then said to be "puffy." The edema may become general, that is, all over the body. This condition is called dropsy. Fluid may accumulate in the abdominal cavity; it is then called ascites, or in the pleural sac around the lungs or in the pericardial sac around the heart, and cause the patient great discomfort, difficulty in breathing and in the action of the heart, and, if the pressure is not relieved, may even cause death.

In nephritis and heart failure with edema a "salt-free diet" will greatly relieve the condition. By degrees the excess salt (and with it the fluid which was only retained to keep it in solution) will be withdrawn from the tissues and the body cavities and eliminated by the kidneys until only the normal amount of salt required by the tissues will be retained. The edema and the patient's discomfort gradually disappear. A "salt-free diet" however is usually very disagreeable to the patient, who naturally craves salt and who will sometimes obtain it if possible, in spite of the fact that he knows it will do him harm. To avoid all such errors it is extremely important that each nurse, even the youngest nurse on the ward, should realize the importance of the strict observance of rules in reference to the diet as well as in the collection of specimens.

Water.—In many diseases and in some forms of nephritis the patient is encouraged to drink large quantities of water. In some forms of nephritis, however, particularly in nephritis with edema, the treatment prescribed by the doctor may be "restricted fluids," so that the patient may be allowed a small amount of water only. A nurse must, therefore, never give even a glass of water to a patient without finding out whether it is permitted or not.

The Abnormal Constituents in Urine (the products of faulty metabolism or of disease).—In a twenty-four-hour specimen of urine the total amount of albumin or of sugar may be accurately measured. Other abnormal constituents for which the specimens may be examined are the acetone bodies (acetone, diacetic acid, and β-oxybutyric acid), indican, ammonia, mucus, pus, blood, urobilin, bilirubin, casts, calculi, iron, iodin, sulphur and bacteria. These abnormal constituents will be better understood after a wider experience and after having heard and studied the lectures on medical disease, and so will be discussed later.

The Collection of a Sterile Specimen of Urine.—When a patient is suffering from a disease of the urinary tract the cause of which may be bacteria or from a disease, such as typhoid, in which the bacteria causing the disease are passed in the urine, the urine is frequently examined in order to detect the presence of bacteria and to find the cause of the disease. A "sterile specimen" is then necessary, that is, one sterile in the sense that it is not contaminated by bacteria from any external source, so that any bacteria found must have come from the urinary tract. In order to obtain a sterile specimen the patient must be catheterized (see chapter on Catheterization). Every aseptic precaution must be taken to avoid contamination. The urine must be received in a sterile bottle, or other sterile receptacle, and the bottle corked with sterile non-absorbent cotton. The tag attached to the bottle must indicate that it is a sterile specimen and state for what the urine is to be examined.

THE URINE OF A NORMAL INFANT

The Amount of Urine.—In the first month a normal infant voids about 200 to 250 c.c. of urine daily and after the first year 500 c.c. daily. Urination should occur at intervals not longer than every two hours when awake or every four hours when asleep.

The Character of the Urine.—The urine is light yellow in color, slightly acid in reaction, having a specific gravity of 1.005, and containing a few leucocytes and epithelial cells.

Any abnormality in the amount or character of the urine, such as indicated by an unusual color or staining of the diaper, should be noted and reported. A specimen of urine should be sent to the laboratory for examination.

Collection of a Urine Specimen from Infants.—In addition to the above conditions, a specimen of urine is usually sent for examination as an aid to diagnosis, where the baby has a continuous temperature from some unknown cause.

A specimen of urine may be collected from a boy baby in a test tube fastened in place with adhesive. Various appliances are used for collecting specimens of urine from girl babies. They are not entirely satisfactory. The simplest and most satisfactory way of collecting a specimen from a girl baby is to place a small tray under the buttocks. The buttocks only rest on the tray. The gown may be turned back or otherwise arranged so that it will not rest on the tray. The small amount voided (one or two ounces) may easily be collected in this way. The tray should be warm. A layer of gauze, if desired, may be placed under the buttocks.

CHAPTER XIII

THE CARDINAL SYMPTOMS

TEMPERATURE, PULSE, AND RESPIRATION

Temperature

The Importance of Close Observation.—The temperature, pulse, and respirations are so constant and conform with such great regularity to a standard in health that we speak of the normal temperature, pulse, and respirations. The mechanism which governs them is so delicate and so finely adjusted that it responds very quickly to any abnormal condition in the body so that any considerable change or departure from normal is looked upon as a symptom of disease; consequently "taking" the temperature, pulse and respirations is one of the first means used in trying to find out the patient's condition. They are so important and such reliable indications of the condition that one of the first duties of the nurse on the admission of each patient is to take and record the temperature, pulse, and respirations. The first question the doctor will ask the nurse is "What is his temperature?" They are such important signals of distress, showing as they do, a disturbance in the most vital organs and functions of the body, that, whether normal or not, as long as the patient is in the hospital they are taken at least twice during the twenty-four hours. If there is any marked departure from normal they are taken and recorded every four hours. The pulse and respirations in critical conditions will be watched constantly and even though the temperature is not actually taken in order not to disturb the patient, a nurse is on the alert to note any increase shown by the expression of the face, the flushed face, the hot, dry skin, the hands hot and tremulous, the lips dry, parched and tremulous, and the rapid breathing.

Again, so important are changes in the temperature, pulse and respirations, so typical of certain diseases and of certain stages in the disease showing its development and decline and the patient's progress, that a special "temperature sheet" is kept on the chart indicating, not only in numerals but graphically by means of dots and lines, the temperature and pulse curves and the relation of one to the other. For instance, in some diseases the pulse will increase in rate as the temperature increases (as in pneumonia and scarlet fever), while in other diseases, such as typhoid, the temperature may increase without a parallel increase in the pulse rate.

This "temperature sheet" is usually the first on the chart so that it is the first record the doctor sees on glancing at the chart. From a glance at this alone in some diseases he is able to judge the patient's condition. In some diseases the temperature is so accurate a signal of the patient's general condition that the treatment is based upon it. For instance, in typhoid fever, the usual order is to "sponge or tub for temperature 103°." The treatment is ordered in this way not because of the temperature, but because the poisons which produced that temperature have likewise caused very destructive changes in the nervous system and the heart, and it is these rather than the temperature which the treatment is intended to relieve and combat. The temperature is a symptom which may be easily and accurately ascertained even by an inexperienced person and it is accompanied by and runs parallel with the other symptoms of injury to the nervous system which are not so definite nor so easily observed and recognized by an inexperienced nurse.

These symptoms or signals of distress held out by Nature,—so easily read and unmistakable, so important, interesting and instructive,—must, therefore, be closely, accurately and conscientiously observed and recorded by the nurse. Even when normal day after day and seemingly of little importance or interest in the case, a nurse must never record a temperature, pulse, and respiration carelessly or inaccurately taken or of which she is in doubt—take it over again or have it checked by someone else. Never take the pulse, etc., mechanically or in a routine way, for you are very apt to make mistakes, and changes in the temperature, etc., should never be ignored or lightly considered. They indicate that the very citadels of the body are attacked and in distress, for Nature never cries "Wolf! Wolf!" like the boy who tried to frighten and mislead his friends into thinking him in danger.

Never be satisfied with any but accurate results; otherwise valuable time is wasted and the results are very misleading and may interfere with the patient's treatment and recovery.

It is not expected that a young, inexperienced nurse will understand fully the temperature, pulse, and respiration as discussed in the following pages. This can only come with a thorough knowledge of anatomy and physiology and with a gradually widening experience. This experience, however, will be of little value without a knowledge of "what to observe—how to observe—what symptoms indicate improvement—what the reverse—which are of importance—which are of none—which are the evidence of neglect—and of what kind of neglect" and without a frequent reference to and checking up of experience with the text.

The Body Temperature

The body temperature, like that of a room or ward, is its degree of heat, and is the balance maintained between the heat produced and the heat lost or dissipated.

The Production of Heat.—The heat of the body, like that from the burning or combustion of coal in a furnace, is the result of the oxidation or combustion of food, chiefly carbohydrates and fats, but also proteins, in the body. These foods if burned in a furnace would likewise produce heat. As we only eat to live and as this production of heat in the body is so vital, the value of food to the body is reckoned in terms of calories, a calorie being the amount of heat necessary to raise one gram of water one degree Centigrade in temperature. One large calorie (C) is the quantity of heat necessary to raise the temperature of 1000 grams of water one degree. Thus the values of the foods are as follows (Howell):

1 gram protein (heat value) = 4100 calories (4.1 C.)
1 gram carbohydrate (starch) = 4100 calories (4.1 C.)
I gram fat = 9305 calories (9.3 C.)

These figures therefore represent the amount of energy (either in the form of heat or mechanical work) these foods are capable of supplying to the body. In this way the heat or energy value of any given diet may be estimated.

Food, however, in the body will not produce heat without oxygen. Just as in a furnace there must be draughts which may be opened or closed in order to regulate the amount of air or oxygen entering according to whether we want the fire to burn up and give more heat or not, so in the body, in order to burn or cause combustion of food with the production of heat, we must have oxygen and a means of supplying it. This, as you know, is provided for by the respiratory apparatus in breathing—oxygen is taken in, carbon dioxide, excess heat, and other waste products, are exhaled. So we must remember that there is a definite relation between the body temperature and the respirations and think of them together.

The production of heat in the body is the result of vital work in every organ and cell of the body, but just as in our homes (while we may have fireplaces) instead of having a stove in every room we have a furnace in the cellar where most of the heat is produced and distributed to the whole house by a system of pipes, air or water, and radiators, so it is, so to speak, in the body. While every cell produces some heat, some are much more active than others, and so we find most of the heat produced in certain organs—the more active they are, the more food they burn, and the more heat is produced. This heat is also distributed by a system of blood vessels, capillaries and blood, to other cooler parts of the body, so that while the temperature of both external and internal parts of the body may vary, the body temperature is on the whole uniform.

The *muscles* and the *secreting glands* are the furnaces of the body where most of the body heat is generated. Everyone knows that, when cold, *exercise,* or the work of muscles, will produce heat and make the body warm. *Shivering,* and chattering of the teeth, which are due to the contraction or work of muscles, are two of Nature's methods of producing heat when the body is exposed to cold. A certain amount of glycogen (carbohydrate or animal starch) is stored in the muscles and in the blood, a household and retail supply, so to speak, ready for instant use. Glycogen is also stored in the liver, the wholesale supply ready to be distributed when the muscles have exhausted their own supply and that of the blood.

This production of heat by the activity of muscles is a matter of common experience so that we find in hot weather and in warm climates people are languid and avoid both the foods (fats and carbohydrates) which produce heat, and exercise. In cold climates the opposite customs prevail.

Again, everyone knows that the *ingestion of food,* particularly hot foods, will increase the warmth of body temperature. The maximum increase occurs about one and one-half hours after eating. *Strong emotions,* excitement, worry, nervousness and anger, etc., will also cause an increase in body temperature, and so we have the familiar expression "keep cool" when we really mean not to get excited or angry. These emotions greatly increase the activity of the secreting glands, such as the adrenal glands, and so increase heat production. They may also stimulate the contractions of muscles, such as in trembling with excitement or anger, and so increase heat production. *Exposure to extremes of temperature* in the surroundings—air or water—may also cause an increase in heat production. *Exposure to cold,* if brief, will stimulate the body to produce more heat in order to protect the body and make up for the heat lost by radiation and conduction from a warmer to a colder body. A *high external temperature* will also increase heat production because it causes increased activity of all the tissues and upsets the balance of heat regulation by direct action on the heat-regulating center in the brain. A sunstroke, for instance, may increase the body temperature to 107° or 110° F.

Conditions which Decrease Heat Production.—Heat production is much more active in the strong and robust than in the *weak* or *badly nourished,* in *fasting* or *starvation,* and when the *vitality is lowered* from any cause, because muscular activity and all the activities from which heat is produced are greatly depressed. They have little heat-producing power, and bear the cold badly. Also *during sleep* the temperature falls so that it is always lowest in the early morning hours. Anyone who has watched the sick knows that life is at a very low ebb during the early morning hours and that this is a critical time for the patient. Anything which depresses the nervous system, whether it be cold, shock, drugs (such as alcohol or morphine), emotions or mental depression, or unconsciousness, will lessen all the activities of the body and therefore the production of heat.

To remember these facts when nursing the sick is extremely important. It is not enough to be able to take the temperature, but we must know when the temperature is above normal, what nursing measures will prevent a further elevation, and, when it is below normal, what we can do to increase the body heat. For instance, when the thermometer or the appearance of the patient tells us that the temperature is above normal (fever), we must regulate the temperature of the surrounding air, and the amount and kind of bed clothing, etc.; we must prevent all unnecessary exercise or exertion, such as sitting up in bed, reaching for a drink or supporting himself, exertion in the use of the bedpan, in turning or lifting, etc. The patient must have rest and all causes of restlessness and discomfort removed; chilling and shivering must also be prevented; all causes of mental irritation or excitement, such as conversing with visitors, must also be avoided. Any one of these will increase heat production and may cause a relapse. The doctor will probably prescribe rest, fasting (liquid diet, easily digested, of low caloric value), plenty of water to drink, and cold sponging or cold tubs to help control the fever.

Again, when the thermometer or the patient's appearance tells us that the temperature is below normal (subnormal), or that he is in a state of collapse or shock, nursing measures must be used to increase heat production. When the natural body processes fail, artificial means must be used by warming the temperature of the room, by hot blankets, hot water bags, hot drinks or foods easily assimilated, a hot foot-bath, a hot mustard bath, and a hot hypodermoclysis, a hot enema, and rubbing the body surface. Oil rubbed over the surface of the skin lessens the elimination of heat; this treatment is frequently used for babies whose vitality or power of producing heat is low.

Heat Lost or Dissipated from the Body.—All the heat formed is not stored up in the body—so much heat would burn up our own tissues so that we would die. Therefore there must be a means of elimination.

Heat is eliminated in the following ways (Howell):

1. Through the excreta, urine, feces, saliva, which are at the temperature of the body when eliminated. It is estimated that 48 calories are lost daily by the urine and feces.

Loss of a large amount of blood, vomiting and diarrhea will lower the body temperature.

2. Through the expired air. This air is warmer than the inspired air, and, moreover, is nearly saturated with water-vapor. The vaporization of water requires heat, which is, of course, taken from the body supply. Each gram of water requires for its vaporization about 0.5 calories. It is estimated that 84 calories are lost daily by the warming of the air, and 182 calories by the vaporization of water from the lungs.

3. By evaporation of the sweat from the skin. The amount lost in this way naturally increases with the amount of sweat

secreted. Three hundred and sixty-four calories are lost daily in this way.

Profuse perspiration and night sweats will lower the body temperature.

4. By conduction and especially by radiation of heat from the skin. One thousand, seven hundred and ninety-two calories are lost daily in this way. This capacity for such an enormous loss of heat through the skin shows the importance of preserving a healthy condition of the skin through bathing, proper clothing, the avoidance of excess loss of heat through unnecessary exposure at all times, and the value of special treatments (hydrotherapy) applied to the skin.

Of course the relative amount of heat lost by the above avenues will vary with the conditions. For instance, in hot weather more heat will be lost by the evaporation of sweat and less by conduction and radiation.

Heat Regulation.—The normal body temperature is the balance maintained between the heat produced and the heat lost. It is extremely important that this proper balance be maintained, for upon this temperature depend the chemical changes which take place in the cells upon which the functions of organs and therefore life itself depends. Anything which interferes with this balance interferes with the functions of the whole body.

In warm-blooded animals, this balance is set at a certain standard or level normal for that particular species, just as we have a standard temperature for the ward. The so-called cold-blooded animals, such as the frog or fish, are those whose temperature varies with that of the surrounding air or water. The warm-blooded animals are those which maintain a constant temperature, summer and winter, practically independent of that of their surroundings. This is accomplished by a heat-regulating mechanism and in man partly by clothing, an artificial means of preventing excess loss of heat through the skin by radiation and conduction.

The most important means of controlling the loss of heat from the body is, as we have seen, by controlling that lost through the skin. This is accomplished by centers in the nervous system which control the circulation of blood through the skin and the secretion of sweat. We can understand this loss or dissipation of heat by radiation and conduction better if we refer again to the heating of our homes by a system of pipes, coils or radiators. You know that the larger the surface of the radiator, or the more coils, the more quickly a room becomes warm, because a large warm surface is in contact with an equally large cooler surface and so more heat is given off. It is the same in the body. The arteries in the skin subdivide into an enormous number of minute blood vessels, the capillaries, and this multiplies enormously the surface exposed to the influence of the surrounding cooler air. Through these vessels a very large volume of warm blood from the muscles and glands, etc., flows slowly, giving off some of its heat to the cooler atmosphere before returning to the interior of the body. When the surrounding temperature is very cold the nerve centers (the vasomotor centers which control the size of the blood vessels) cause the blood vessels in the skin to contract so that less blood flows through the surface in contact with the cold and less heat is lost. The sweat centers also check the secretion of sweat so that less heat is lost by evaporation. Again, the effect of the cold on the nerve endings in the skin stimulates the nerve centers which set at work the processes which produce heat—shivering may occur and the appetite is stimulated so that we eat more food. When the surrounding air is warmer the opposite effect takes place; we eat and move about less, the blood vessels in the skin dilate, more blood flows through them, more heat is lost and sweating may be profuse.

Increased respiration also increases the loss of heat. It is thought also that in the nervous system there are definite heat-regulating centers which, to meet the needs of the body, can stimulate or inhibit all the activities which result in heat production or heat elimination. They act, so to speak, like the regulator or thermostat.

These centers will struggle against any marked change from the normal temperature until they themselves become exhausted or poisoned by toxins or paralyzed by other means.

In infants and young children the heat-regulating mechanism is not so fully developed as in an adult, so that they are very susceptible to the influence of the external temperature, and also to all disturbances likely to cause an elevation of temperature, or fever.

The Normal Body Temperature.—The body temperature is measured by means of a thermometer placed in the mouth, axilla, rectum, or vagina. The temperature of the interior of the body is higher than the exterior, the average temperature of the blood being about 102° F., that of the skin being about 90 to 92° F. The temperature of the skin also varies, being higher over a muscle (an active organ) than over bone and higher over an active organ than over one at rest. The temperature of the interior of the body, for instance, the mouth, rectum, and vagina, varies also, according to the blood supply and the extent to which it may be influenced by external conditions. The normal temperature in the mouth is 98.6° F., in the axilla slightly lower, in the rectum or vagina about 1° higher than the mouth. The temperature varies during the day and also there are individual peculiarities according to the manner of living and the time of meals, etc. A person living a confined, sedentary life is apt to have a lower temperature than one living an active, hearty, out-of-door life. The temperature is lowest between 2 and 6 A.M. (the critical hours when the patient will probably need blankets, hot-water bags, hot drinks, etc.), rising gradually during the day (due to food and exercise), reaching the maximum between 5 and 7 P.M., and again falling during the night. The difference between the early morning and the late afternoon or evening temperature may be a fraction or one degree more. It should be measured therefore for each patient at the same hours each day for accurate comparison. The temperature also varies slightly with age, that of an infant or child being usually 1° higher than that of an adult because the heat-regulating apparatus is not so efficient. After thirty the temperature is said to fall about 1° below the average, while in very advanced age it rises 1° higher than the average. "In the matter of body temperature as in so many other characteristics, aged people show a tendency to revert to infantile conditions." The temperature is also somewhat affected by the temperament, excitable people, for instance, being apt to have a higher temperature.

Departure from the Normal Temperature.—Slight variations from 98.6° F. are not usually considered abnormal—variations within the limits of from 97° to 99° are usually not significant. Apart from the deviations indicated above, compatible with health, any departure from the normal temperature indicates that there is something wrong in the body. The elevation of temperature, however, is not always an index of the seriousness of the disease, for it may be higher in the shorter, less serious or fatal infections than in the most fatal. For instance, the temperature in tonsillitis is frequently higher than in diphtheria, and in some fatal infections there may be no elevation at all. A prolonged high temperature is always very serious. Recovery seldom occurs at a temperature above 107° F.

The following classification is commonly used to describe the various degrees of temperature:

Hyperpyrexia	105° F and over
High fever	103° to 105° F.
Moderate fever	101° to 103° F.
Low fever	100° to 101° F.
Subfebrile	99° to 100° F.
Normal	98.6° F.
Subnormal	97° to 98.6° F.
Collapse	95° to 97° F.
Algid collapse	below 95° F.

The extremes of these temperatures, if maintained, are fatal to life. Even a slight elevation of temperature—99° to 99.6° F. —occurring persistently every afternoon or evening, may be, and frequently is, an early symptom of such a serious disease as tuberculosis.

Temperatures Above Normal—Fever.—Fever is due to a disturbance of the heat-regulating centers. Heat-production is increased out of proportion to heat-elimination, which may even be diminished. The dry, cold, pale skin present in some fevers shows that heat is not being lost by radiation, conduction, or evaporation.

Fever may be due to a variety of conditions and the treatment will depend somewhat upon the cause. In sunstroke, in which the temperature may rise to 109 or 112° F., the cause is the exposure to the extreme external heat which increases the temperature of the blood and renders the heat-regulating centers powerless. In that case or in any case where the temperature remains high for a prolonged period, every available means are taken to cause a reduction because the extreme body heat will cause such increased chemical changes, combustion and destruction of the body tissues themselves that death will soon result—even a furnace or an iron stove will finally wear out and be destroyed by continued extreme heat. The temperature in sunstroke seems to be an unmitigated evil which must be combated.

Nervous impressions, hysteria, and prolonged extreme pain may also cause fever. More common causes are the acute infectious diseases, acute local inflammation, such as appendicitis, peritonitis, and infected wounds, toxemia, septicemia, uremia, and ptomaine poisoning. In the above conditions, in which the body is being poisoned by the toxins absorbed from bacteria or from decomposing substances, the fever is not an unmitigated evil but a protective, defensive reaction on the part of the body by which it struggles to make the body inhospitable to the bacteria, so to destroy them and combat their toxins. The way in which the fever is produced is not entirely understood. Some think that the toxins depress the centers which cause heat-elimination. Some think that possibly the heat-regulating centers set the standard or normal body temperature at a higher level for the time being, just as we put more coal in the furnace to make our houses warmer to protect us from very cold weather. At any rate it is believed that the body can defend itself and put up a better fight against the bacteria and their toxins at an elevated body temperature. It is true that this high body temperature may be injurious to the body tissues and interfere with their function, but it will be equally or more injurious to the bacteria, checking their destructive invasion, and Nature throws all her energies into the struggle of self-preservation even at the temporary risk to her own tissues. Formerly the fever accompanying these diseases was looked upon as an unmitigated evil and every known means was taken to combat it. It is now recognized that where the temperature is not elevated the prognosis is grave, because it shows that the body is unable to defend itself in this way. To-day, as stated previously, cold sponges, etc., are ordered, not to reduce the temperature, but to relieve the poisonous effects of the toxins on the nervous system, heart, blood vessels, and other organs. Even in these diseases, however, when the temperature is persistently high, the danger to the tissues is so great, efforts are made to reduce it. Drugs (antipyretics) formerly used to reduce the temperature are now seldom used because the protective action of the fever is recognized and the danger from a sudden drop in temperature. These drugs also depress the heart, lower the resistance, and interfere with the patient's recovery.

In nursing fevers it must be remembered that the heat-regulating centers are so disturbed and overtaxed, their resistance and control so reduced, that conditions which at other times would not affect the temperature, may cause a rise. Great care must be taken to avoid all conditions likely to cause an increased heat production or a diminished heat elimination.

Temperatures Below Normal.—As stated previously, the body must maintain a certain degree of heat in order to carry on the chemical changes in the tissues upon which the maintenance of life depends. Life can be maintained for a short time only at a temperature of 95° F. or below. Subnormal temperatures may be due to (1) excessive heat elimination, as from profuse sweating, night sweats, a severe hemorrhage, or loss of other body fluids; (2) lessened heat production, as in starvation and lowered vitality. In starvation the patient lives on his own tissues, the muscles and other tissues being used to supply the heat and energy necessary to carry on the vital functions of the heart and respirations, etc. These are spared until the last. (3) Extreme depression of the nervous system as in shock or collapse. All the nerve centers which control and stimulate the functions of the body are depressed and inactive so that the functions of every organ, including the heart and lungs, will be weakened and may be entirely suspended. For the treatment of shock, see Chapter XXXII.

The Course of the Fever, or the **Temperature Curve.**—Fevers usually run a typical course and last for a fairly definite time, characteristic of that particular disease, so we commonly hear it said that "the fever must run its course." In some diseases the "temperature curve," or the diagrammatic representation of the course of the fever on the chart, is so characteristic that the diagnosis is suggested at a glance so that we say this is a typical pneumonia, typhoid, or malaria chart.

Fever begins in one of two ways. The *onset* or *invasion* (the period when the temperature is rising) may be very sudden and violent, as in pneumonia and scarlet fever. The temperature rises very abruptly, usually accompanied by a chill or in a child by a convulsion (an exaggerated chill), or it may be a gradual onset as in typhoid. The temperature rises higher each day, reaching its maximum in two or more days, and the other symptoms, headache and backache, etc., become more severe. After the temperature has reached its maximum it usually remains high, though there may be wide variations, for from a few days to two or three weeks. This period of more or less constantly high fever is called the *fastigium* or *stadium.* Stadium comes from a Greek word, meaning a measure of distance used in races, and fastigium from a Latin word, meaning the ridge of a roof.

The fever will also subside in one of two ways. Like the onset, it may be very sudden and abrupt, the temperature falling

4 or 5 degrees within a few hours, and reaching to or below normal in from 12 to 24 hours, accompanied by a marked improvement in the patient's condition—the breathing and pulse become more normal in rate and character, the patient falls into a sound sleep from which he wakens refreshed, with mind clear, a new being, normal but very weak. Sweating and the voiding of an increased volume of urine usually occur during this period. This is called the *crisis,* and it is one of the most dramatic and wonderful phenomena in medicine. It occurs in pneumonia, malaria, and scarlet fever, etc. In pneumonia, on examination of the lungs, the congested condition is found to be the same after the crisis as before, but all the other symptoms of the disease, due to the toxins which have been rapidly poisoning the whole system, have subsided. It is thought that the body has been carrying on a tremendous fight against these toxins and has at last succeeded in preparing sufficient antitoxins to overwhelm them. It seems that the chief battle the body has to engage in is that against the toxins produced by the bacteria rather than the bacteria themselves. Again, it is not so much the drop in temperature, but the subsidence of the symptoms due to the toxic condition which marks the improvement or true crisis. The crisis, as the word suggests, is a very critical period, the outcome being almost certain recovery or probable death, so the patient must be watched very closely. He may go into collapse and die.

A sudden fall in the temperature not accompanied by an improvement in the general condition, but rather by an increase in the pulse rate, with rapid shallow respirations, and increasing weakness, is not a true crisis, but may indicate a severe internal hemorrhage, a perforation of the intestines, or approaching death. In such cases the drop in temperature is a very alarming danger signal and not a sign of improvement.

The fever may subside very gradually, as in typhoid, the temperature falling step by step in a zigzag manner for two or three days or a week before reaching normal, during which time the other symptoms also gradually disappear. The fever is then said to subside by *lysis.*

Types of Fever.—Fevers in different diseases run a characteristic course and are classified as "constant," remittent," and "intermittent" according to the diurnal variations. For instance, in looking at the temperature curve on the chart in pneumonia you will see that the temperature remains constantly high with only a slight (not more than 2° F.) variation between the morning and evening temperatures. This is a "constant" or "continuous" fever. Sudden changes during a "constant" fever usually indicate complications. If the fever is extensively prolonged, it also usually indicates complications, frequently tuberculosis.

The temperature curve in septic fever, remittent fever, and during the invasion and lysis in typhoid, shows a variation of more than 2° F. and usually not less than 3° F. between the

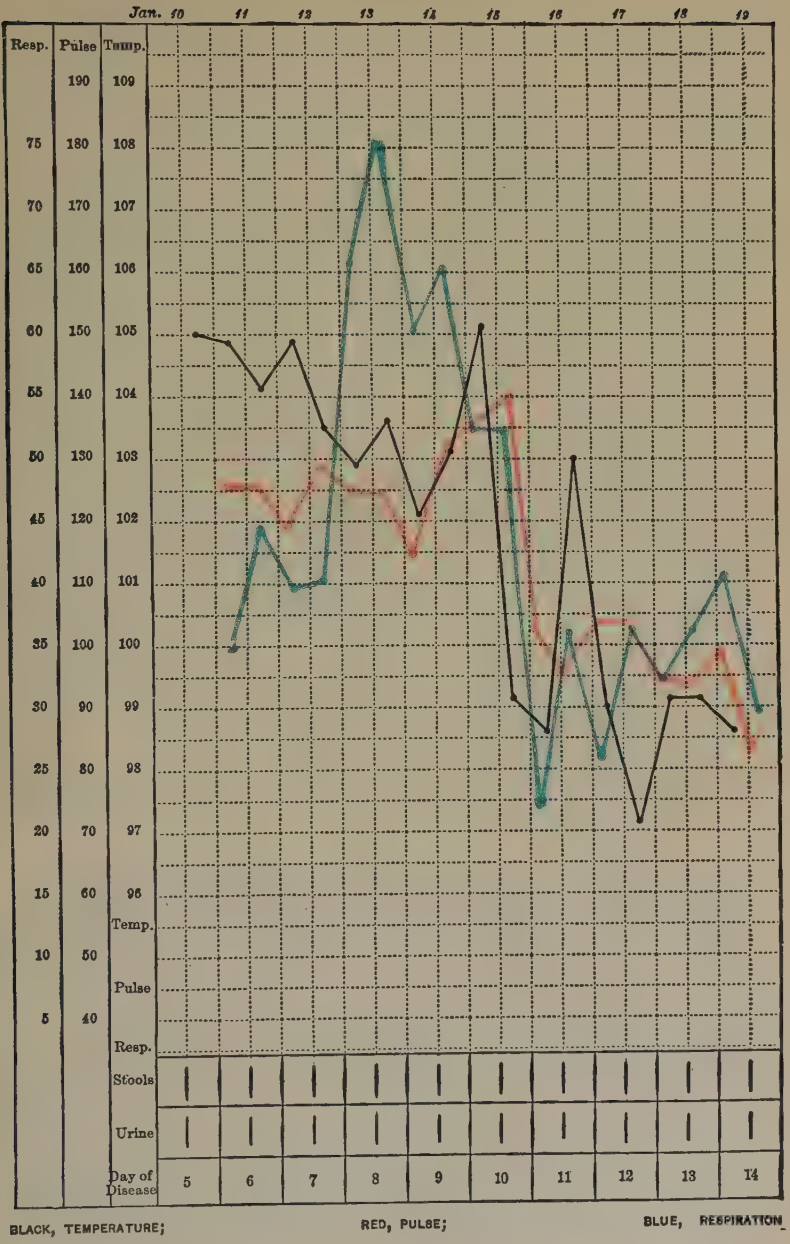

FIG. 6.—TEMPERATURE, PULSE AND RESPIRATION IN PNEUMONIA. (From Osler's "The Practice of Medicine," D. Appleton & Company, Publishers.)

morning and evening temperatures, the lowest point, however, never reaching normal. This is called a "remittent fever."

In "intermittent fever" a sudden rise of temperature is followed by a sudden fall to or below normal, the fall usually being accompanied by profuse sweating. This alternate rise and fall of temperature may occur daily or after the lapse of a regular number of days, as in tertian malaria. The fever accompanying

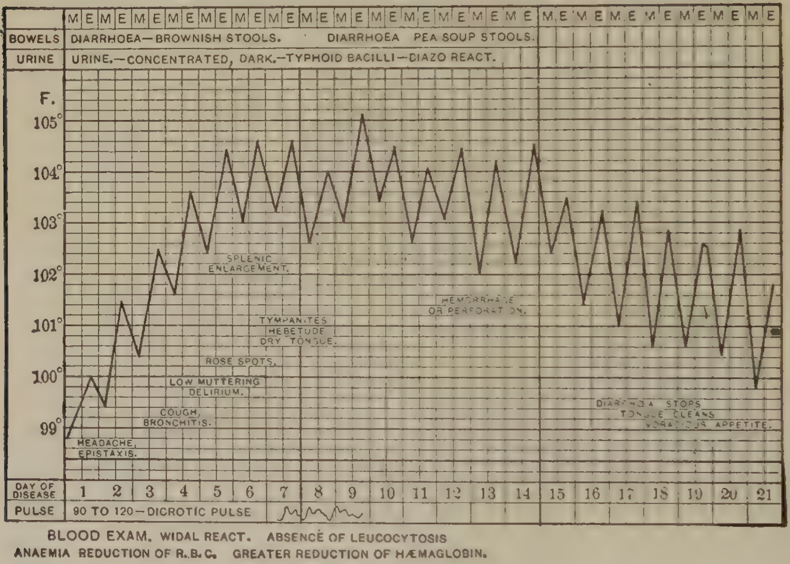

FIG. 7.—TEMPERATURE CHART IN TYPHOID FEVER.. (From Farr's "Internal Medicine for Nurses [from Musser]," Lea and Febiger, Publishers.)

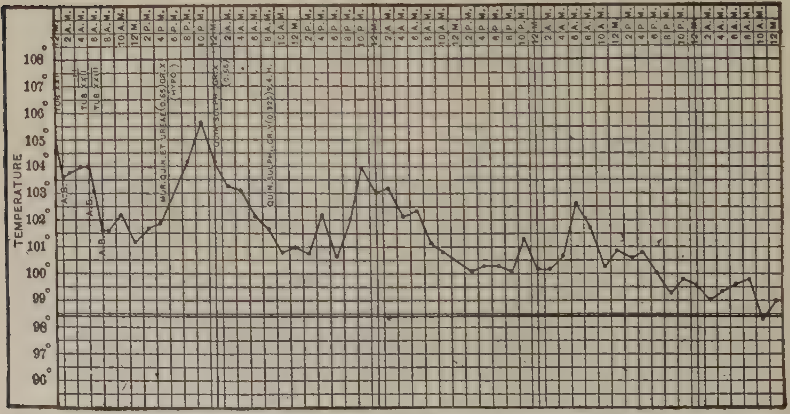

FIG. 8.—REMITTENT FEVER CHART—ÆSTIVO-AUTUMNAL FEVER. (From Osler's "The Practice of Medicine," D. Appleton & Co., Publishers.)

septic conditions, such as advanced tuberculosis, septicemia, and pyemia, is frequently "intermittent," but may be "remittent." A prolonged "intermittent" fever such as in advanced tuberculosis is frequently described as "hectic."

During convalescence from fevers there may be a recrudescence or recurrence. The elevation in temperature, etc., may be merely temporary, due to excitement as from the visit of friends, to overfeeding or the first solid food, to constipation, or to some unusual exertion, such as sitting up in bed, or to similar causes. Such a recurrence, however, should receive the most careful attention as it may mean a true relapse of the previous disease which must again run its course, or it may indicate complications.

The Clinical Thermometer.—The Fahrenheit, self-registering, clinical thermometer is the instrument commonly used in the United States, Canada and Great Britain for measuring the body temperature. The Centigrade scale is used in European countries. The thermometer consists of a glass bulb containing mercury, and a stem in which the column of mercury may rise. On the stem is a graduated scale representing degrees of temperature, the lowest degree registered being 95° F., the highest 110° F., because neither at a body temperature below or above these points can life be maintained. The stem usually has a curved surface which magnifies the lines and figures on the scale, and a flattened back with a sharp ridge which makes it easier to read the scale and also prevents rolling, and so lessens the danger of breakage. The principle upon which the use of the thermometer is based is that mercury expands with heat, the height to which the column rises depending upon the degree of

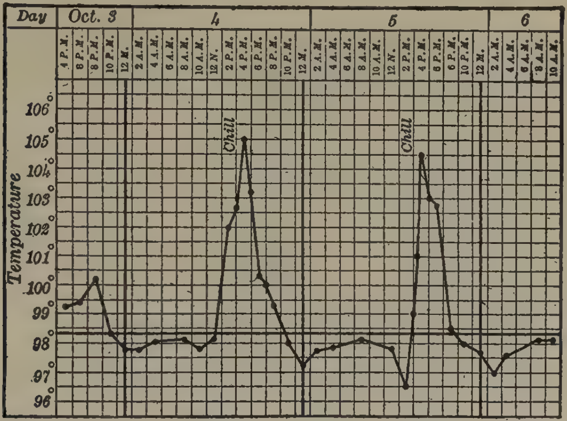

FIG. 9.—INTERMITTENT TERTIAN FEVER—MALARIA WITH CHILLS. (From Osler's "The Practice of Medicine," D. Appleton & Co., Publishers.)

heat, which it therefore accurately registers, because in the self-registering thermometer the mercury stays at this height until shaken down. Needless to say, the thermometer must not be used for anything hotter than 110° F., for the mercury would continue to expand and would break the stem. Before using the thermometer, see that the mercury does not register above 95° F. To shake the mercury down grasp the thermometer securely by

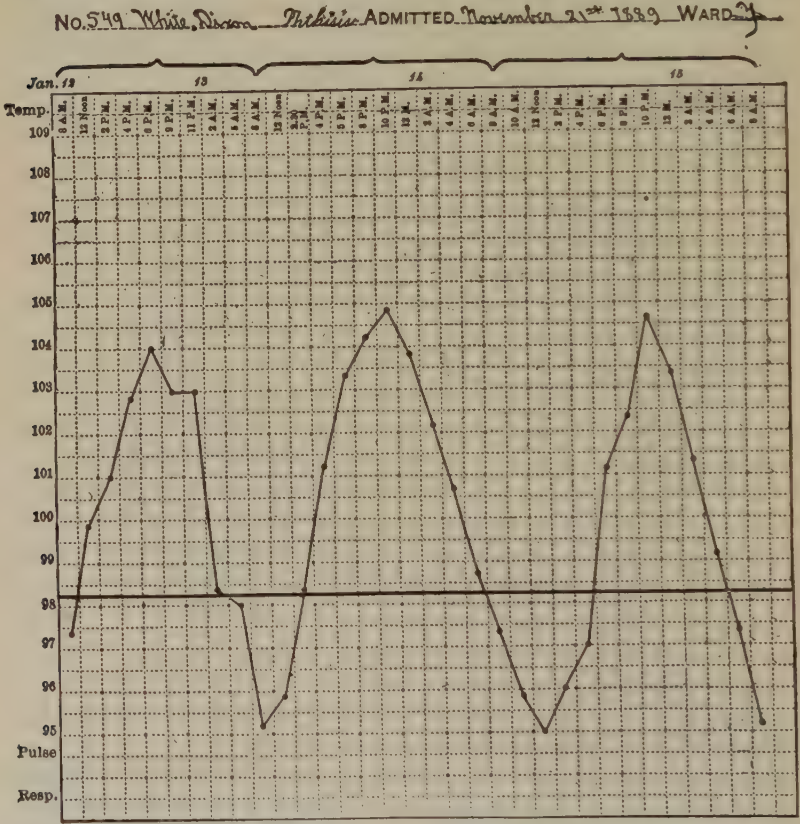

FIG. 10.—INTERMITTENT FEVER OF TUBERCULOSIS. (From Osler's "The Practice of Medicine," D. Appleton & Co., Publishers.)

the upper end (never hold it by the bulb), flex the hand, and give a quick sudden movement of the wrist as when snapping the fingers or cracking a whip. Do not shake the mercury below 95° F., as it may be difficult to get it up again. Be careful not to let the thermometer fall or strike against anything.

The body temperature may be ascertained by placing the thermometer in the mouth, the axilla, groin, rectum, or vagina. The temperature sought is that of the interior of the body uninfluenced by contact with clothing, air, or moisture, etc., so the thermometer must be placed where it can be completely surrounded by body tissues and where there are large blood vessels and a free circulation of blood near the surface. The nearer these conditions are approached, the more accurate the temperature taken will be.

In taking the *temperature by mouth,* place the end of the thermometer containing the mercury under the tongue, because here it will be close to large arteries. See that the lips are kept tightly closed and that the patient breathes through the nose only. The mouth should be thoroughly clean. Leave the thermometer in this position until the mercury reaches a constant height, but do not leave it longer than necessary. The time will depend upon the thermometer used and varies from two to five minutes. The best grade of thermometer will register in one-half minute, but as the mouth contains air derived from the exterior, the lips must remain tightly closed for at least two minutes to allow it to warm up to the body temperature. The normal temperature of the mouth is 98.6° F.

When Not to Take the Temperature by Mouth.—The mouth is the most convenient place for taking the temperature, but should not be used immediately after the patient has had hot or cold drinks or food or when she has been breathing through the mouth, or when having cold or hot applications applied to the face or throat. Do not use this method when the patient has difficulty in breathing from any cause, or when the mouth cannot be closed for the required time, for instance, when the patient has an acute cold in the head or inflammation of any part of the respiratory tract, with obstruction, sneezing, or coughing, etc.; or after an operation on the nose, when the nose is "packed" with gauze, and also when the mouth cannot be kept closed from extreme weakness. It must not be used when the mouth is dry, parched, inflamed, or covered with sores; it must never be used for children, for restless, nervous, delirious, unconscious, hysterical, or mentally ill patients because of the danger of biting and breaking the thermometer and swallowing the glass and mercury. The mercury, if swallowed, would probably do no harm, because in its metallic form it is inert, that is, it does not combine with the tissues of the body in any way, therefore has no influence upon them and can do no harm, but would probably be discharged through the intestines. The broken particles of glass, however, if swallowed would do harm, so if a thermometer should accidentally be broken remove all particles of glass from the mouth. If any glass has been swallowed, eating bread or some other soft food will help to prevent injury to the lining of the alimentary tract. Report the accident at once to the doctor, who, as a precautionary measure, will probably prescribe the white of egg, which is largely albumin. Albumin is the antidote for mercury and renders it harmless. It forms a coating around each molecule of mercury so that it cannot come in contact with the tissues and it also combines with it chemically, forming a new harmless substance.

If the temperature taken by mouth seems unusually low, or if there is any doubt of its accuracy, take it over again, or take it by rectum, or take it with another thermometer.

The Axillary Temperature.—The temperature is sometimes taken by axilla when it cannot be taken by mouth because it is convenient, hygienic and occasions little discomfort or exertion to the patient. Before placing the thermometer in position see that the axilla is free from moisture or perspiration, but do not rub the part because the friction may increase the temperature and make it inaccurate. See that the bulb is placed securely in the axilla and that it is completely enclosed by the body tissues by placing the arm over the chest with the fingers on the opposite shoulder. Do not allow the clothing to come in contact with the thermometer. It must remain in position ten minutes.

For infants, the groin temperature is sometimes taken. The thigh must be well flexed over the abdomen. Ten minutes are required for registration.

The axillary and groin temperatures are usually about one-half degree lower than that of the mouth.

The rectal temperature is the most reliable and is generally used for very ill or toxic patients, for infants, children, restless and delirious patients. This method cannot be used after rectal operations, or when the rectum is diseased, inflamed or not perfectly clean. Bacteria are always present in fecal matter in which they cause decomposition or combustion with the production of heat. The presence of fecal matter would therefore increase the rectal temperature possibly one degree higher than it should be. Oil the bulb before inserting it to prevent irritation —irritation is not only a discomfort, but it draws an increased supply of blood and therefore heat in the part. It also stimulates the muscles of the rectum to expel the thermometer. Insert the bulb about two inches. The rectal temperature is usually from one-half to one degree higher than that by mouth, because it is a closed cavity less influenced by external conditions and because in the rectum there is a large plexus of veins close to the surface lining and therefore a large volume of warm blood.

Never leave children or restless, delirious or hysterical patients alone with a thermometer, for their restless movements are apt to displace or break it. Hysterical patients, and sometimes others, also, occasionally try to mislead the nurse into thinking that their temperature is elevated by "sucking" the thermometer or holding it on a hot-water bag or in hot fluids, etc.

The Care of Thermometers.—Thermometers, whether used for mouth or rectal temperatures, should be rendered scrupulously clean and free from infection after use by washing thoroughly in cold water and allowing them to stand in an antiseptic solution (usually bichlorid of mercury 1 to 2000) long enough to disinfect them. This is necessary both for esthetic reasons and also to avoid carrying infection to either the mouth or rectum. Those used for rectal temperatures should be marked and kept separate. In hospitals, thermometers with colored glass bulbs are usually used for rectal temperatures. If possible each patient should have a separate thermometer but in hospitals for adults this is seldom practicable or possible. Infectious diseases are so prevalent among children and infants, and children are so susceptible to infection, that separate thermometers are essential. In infectious diseases in adults separate thermometers are also essential. A separate jar of vaseline should also be kept for lubricating rectal thermometers used in infectious diseases.

All thermometers should be tested and compared at regular intervals with a standard thermometer, because the glass gradually contracts so that, after a time, the readings are inaccurate, being slightly too high.

CHAPTER XIV

THE CARDINAL SYMPTOMS (Continued)

The Pulse

The pulse is the distention or pulsation of the arteries produced by the wave of blood forced through them by the contraction of the left ventricle during systole. This contraction is called the heart-beat. Each time the heart beats it forces about 3 ounces of blood into the already filled aorta. This causes an increased pressure of blood which (as the blood is confined within closed tubes) drives the column of blood onward toward the capillaries. The increased volume of blood also exerts a lateral pressure, that is, an increased pressure against the walls of the arteries, which, being highly elastic, stretch or expand, the degree of expansion depending upon their elasticity and tone. This pressure and expansion pass from point to point in the elastic wall as the column of blood moves onward so that it proceeds in the form of a wave—the "pulse wave." This pressure and rise of the artery may be felt by placing the fingers along an artery which runs near the surface. This is the "upward curve" seen on "pulse tracings," due to the impulse caused by the heart-beat. If this were the only provision for the circulation of the blood, it would cease to flow when the heart-beat was completed and so the supply of blood (with food and oxygen, etc.) brought by the capillaries to the tissues would be very irregular, either a feast or a famine. The walls of the arteries, however, are highly elastic and contain muscles which are also elastic so that like all elastic tissue the arterial walls offer a certain resistance to stretching or pressure made upon them and strive to resume their original size. When the heart stops contracting the semilunar valves are closed, and no more blood flows into the arteries, their elastic walls recoil and press constantly and steadily upon the blood within them so that it is again driven onward. As this recoil proceeds all along the arteries until the next heart-beat, the blood is kept constantly moving through the capillaries and veins—the impulse or beat of the heart is followed, as it were, by the impulse or beat of the arteries. This steady recoil of the arteries is the downward curve of the pulse when the artery is felt to recede from the examining finger. The *upward curve*, corresponding to the *systole* or working period of the heart, and the *downward curve*, corresponding to the *diastole*, or resting period of the heart and produced by the recoil of the elastic arterial walls, constitute the pulse. Whatever interferes with the function of the heart, with the volume of blood or with the elasticity and contraction of the blood vessels, will cause a change in the pulse.

The Importance of Accuracy in Taking and Recording the Pulse.—Feeling, or "taking" the pulse is, therefore, a quick, convenient, and (in the hands of an experienced person) a reliable means of gaining valuable information concerning the condition of the heart, blood vessels, and circulation. The heart is a vital organ. Information concerning it is, therefore, of vital importance: The life of every cell, the function of every organ, life itself, depend upon a constant circulation of blood through the capillaries and this depends not only upon the heart, but upon the elasticity and tone of the blood vessels. Information concerning them is therefore also of vital importance. The heart and blood vessels are controlled or regulated by the nervous system so that anything which interferes with its function (such as injury or pressure upon it), or which stimulates it—excitement, anger, cold, drugs, toxins, or poisons, etc.—or which depresses it—worry, shock, collapse, drugs (ether, alcohol, etc.), toxins or poisons,—will be indicated by a change in the pulse. Again as the circulation is maintained merely to meet the needs of the body (the heart even quickening its beat to meet the added slight exertion required of the sitting over the reclining position), any abnormal condition of the body will be responded to by a change in the heart and blood vessels, and therefore, in the pulse. Abnormal conditions in the heart and blood vessels themselves will, of course, cause a change in the pulse, so that the pulse gives valuable information concerning the heart, and the patient's general condition also. In diseases such as the acute infections the pulse is a valuable indication of the effect of the disease on the patient, his resistance to it, the prognosis, and the treatment advisable. In fevers, even when the temperature is very high, if the pulse shows the heart and blood vessels to be holding their own, the prognosis is favorable. In accidents and other emergencies, either surgical or medical, feeling the pulse tells at once, without loss of valuable time, the degree of shock and the need for stimulation, and so, in many instances, an understanding of the pulse may be, and often is, a means of saving life.

The heart is one of the last organs to give out. It has been found beating even after death, so that the pulse is a valuable indicator of the prognosis and treatment as well as of the diagnosis. Symptoms of failure of the heart are always serious.

A few years ago—not more than fifty—the pulse was the only means available of studying the condition of the heart, so that both physicians and nurses became wonderfully expert in reading and understanding it. To-day, while there are instruments which record more accurately certain characteristics of the pulse, it is said that the study of the pulse by feeling the artery with the finger is, and always will be, a very important factor in the diagnosis, prognosis, and treatment of disease. For the nurse "taking" the pulse will always be one of her most important duties, and she should remember that the life of the patient may often depend upon her intelligent and accurate observation and recording of this most important symptom. This requires a great deal of experience and as experience comes only with practice, she cannot begin too early to study the characteristics of the normal pulse, to compare the pulse in disease with the normal, and to study the pulse in relation to the disease in which it occurs. An understanding of the pulse depends upon a thorough understanding of the circulatory system which may be attained from a study of the text-book on anatomy and physiology supplied to students.

The pulse of a patient is always taken twice during the twenty-four hours, much more frequently, every four hours, in some cases, and is constantly watched when the patient's condition is critical and when a change either for better or worse is expected. It is also taken before, during, and after many nursing procedures or treatments requiring exertion, mental or physical strain, or pain, or which are apt to affect the heart and circulation either directly or through the nervous system which controls it. For instance, it is taken when the patient is sitting up for the first time after an operation or a long illness, or when very cold or hot baths or packs are given, or an aspiration of a body cavity such as the pleural, the abdominal, or pericardial cavity, or the spinal cord.

Where the Pulse can be Taken.—Any large, superficial artery which rests directly upon a bone against which it can be compressed can be used for taking the pulse. The radial artery is usually used because it is most convenient, accessible and compressible, as it lies just underneath the skin of the inner surface of the wrist and directly over the radius. When for any reason the wrist is not accessible, for instance, when it is swathed in dressings, a plaster cast, splint or restraining straps, the temporal, facial, carotid, femoral, or dorsalis pedis arteries must be used. Each of these, except the carotids, may be compressed against a bone, and felt at the points indicated in the accompanying diagram.

The temporal artery may be used sometimes with less disturbance to the patient and must be used during such treatments as a hot or cold pack when the body is completely wrapped in blankets or sheets. The carotid arteries, although not resting on a bone, are large, near the surface, and quite close to the heart, so the pulsations derived from the heart-beat may be felt here when imperceptible at the wrist. The pulsations, in some diseases, may be seen and counted in the temporal and carotid arteries without touching the patient. The pulse may sometimes be felt also in the femoral artery when imperceptible in the wrist, because it is larger and nearer to the heart. It is said also that the blood-pressure can be more accurately judged in the femoral artery. When possible, use the same artery each time. Arteries differ in size, therefore in the volume and velocity of the blood

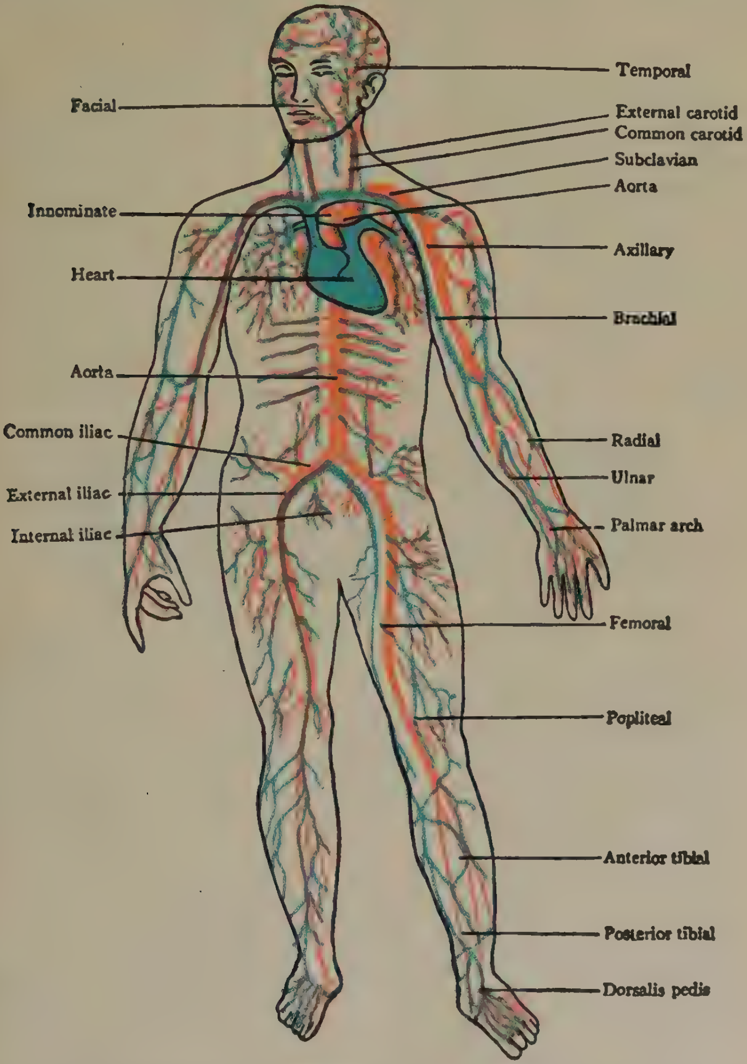
Temporal
Facial
External carotid
Common carotid
Subclavian
Aorta
Innominate
Axillary
Heart
Brachial
Aorta
Common iliac
Radial
Ulnar
External iliac
Palmar arch
Internal iliac
Femoral
Popliteal
Anterior tibial
Posterior tibial
Dorsalis pedis

FIG. 11.—THE PRINCIPAL ARTERIES OF THE BODY SHOWING WHERE THE PULSE MAY BE TAKEN. (From Morrow's "Immediate Care of the Injured," W. B. Saunders Co., Publishers.)

flowing through them, and also in the structure of their walls, the largest having more elasticity, the smaller being more muscular. You have to know what the artery feels like normally in order to be able to detect slight but important differences in the pulse.

How to Feel the Pulse.—Place the tips of three fingers on the artery, exerting just enough pressure to make the pulse most distinct. Never use your thumb because it also has a pulse and this might be confused with that of the patient. Three fingers (the first, second, and third) are used because, as you remember, the blood travels in the form of a wave, alternately rising and falling, and it is the character of this wave which we must study. Again, certain characteristics are studied by compressing the artery with the other two. Count for a full minute in order to study the rhythm or regularity of the pulse.

Before starting to take the pulse, see that the patient is in a comfortable position and that the part (the arm, etc.) is at rest and supported. Do not take it immediately after the patient has been subjected to any physical exertion or any painful experience, either mental or physical. In a nervous, excitable, or self-conscious person the mere act of taking the pulse may greatly increase its rate and alter its character. The patient should have his attention diverted, and your fingers should remain in position until after the excitement, etc., has subsided. At any time do not be in a hurry; be sure that you yourself are calm and in a condition to give thoughtful attention to what you are doing; feel the artery, get used to it before starting to count, or study the character of the pulse.

When taking the pulse at the wrist, the arm should be supported and the forearm semipronated as the pulse is then more easily felt. When counting the pulse of a patient for the first time, always examine both radial arteries because frequently one may be abnormal in its size or course or may be diseased, injured, or subjected to pressure at some point so that the pulse in that artery would be misleading. Verify your readings by using other arteries. When in any doubt, ask a more experienced nurse to take the pulse and check your results before charting. Chart the pulse, or at least record it on paper at once to avoid errors.

What to Note when Taking the Pulse:

1. The condition of the wall of the artery.
2. The tension or compressibility of the artery.
3. The volume of the pulse, the size and shape of the pulse wave.
4. The rate of the pulse.
5. The rhythm of the pulse.

The Normal Pulse.—The artery should feel firm, round, smooth, elastic, and straight (the temporal artery is twisted or tortuous), the tension should be moderate, and the pulse not obliterated by moderate pressure. The pulse wave should be medium, rising and falling neither abruptly nor abnormally slowly; the artery should be just perceptible between the beats;

each successive beat should be of equal force; the intervals between beats should be equal in length and the number of beats per minute should be normal for the particular individual depending upon the age and sex, etc.

The characteristics of the normal pulse and the abnormalities which may occur in disease may be more clearly understood by a study of a "pulse tracing" of a normal pulse as recorded by the sphygmograph. This is an instrument with which graphic tracings may be made showing a magnified record (magnified because otherwise too small to be recorded) of the pulsations of the artery made by the "pulse wave," thereby recording regularities or irregularities in it which may be studied at leisure. It consists of a button which is placed over the artery with moderate pressure. The button is attached to a steel spring, which, in turn, is attached to a lever with a writing style which records the tracings of the rise and fall of the artery on smoked or white paper.

The upward curve (see figure 12) is called the *primary curve* and represents the expansion of the artery caused by the sudden inflow of blood during the forceful contraction of the left ventricle—the heart-beat. This measures the force of the heart-beat. The upward curve is normally smooth. In the *downward curve* there are several waves represented (pulsations of the artery), the one which concerns us being the one in the middle of the curve. It is called the dicrotic wave because in the middle (*di* meaning two), and because, in certain diseases, this dicrotic wave is so exaggerated and pronounced that it gives the sensation of a double beat of the heart. The slight wave preceding the dicrotic is called the *predicrotic*, the one following the *postdicrotic*. These need not concern us. Normally these pulsations or waves are all imperceptible to the examining finger. In some diseases the dicrotic wave is so pronounced, the pulse is spoken of as the "dicrotic pulse," and it is necessary that you should recognize and understand it.

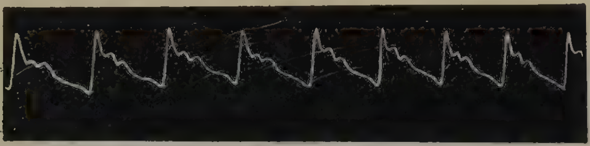

Fig. 12.—Sphygmographic Tracing of a Normal Pulse. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

You will notice that the downward curve is much more gradual than the upward curve. This is because the upward curve is due to the forceful heart-beat while the downward curve is brought about entirely by the elastic recoil of the walls of the artery. The upward curve represents the systole of the heart when blood is streaming into the arteries and the artery rises against the fingers. The downward curve represents the diastole of the heart. The semilunar valves are closed, blood has ceased to flow into the aorta, the elastic walls are returning to their original size, pressing constantly and steadily on the blood and sending it onward, and the artery is felt to fall away gradually from the fingers. The "dicrotic wave" is caused by the closure of the semilunar valves. The elastic wall of the aorta as it recoils drives the blood in two directions—onward and back against the closed semilunar valves against which it strikes with considerable force, depending upon the original force of the heart-beat. From this wall of resistance and sudden check to its flow it rebounds, and this rebound causes the expansion of the artery, called the dicrotic wave, which, however, as stated previously, is not normally perceptible to the examining finger.

1. **The Condition of the Wall of the Artery.**—Normally in young persons when the flow of blood is shut off in the radial artery with one finger, the empty artery beyond cannot be felt. As one grows older, however, the arteries lose their elasticity because of the formation of fibrous tissue in the wall which makes it stiff, thicker, less elastic, and in old age the artery may be leathery, rigid, hard and unyielding. This is a form of arteriosclerosis, "hardening of the arteries," more apt to develop in those who have done hard muscular work or who have led a life of severe mental strain and worry. Overeating and severe mental or physical strain are important factors. Arteriosclerosis occurs also as a result of disease such as Bright's disease and gout. The artery feels like a rubber tube which can be rolled under the fingers when empty and stands out visibly between the heart-beats. In more advanced arteriosclerosis, the arteries seem to be stretched in length so that in the limited space they are forced to become twisted, tortuous, or "snake-like." In still more advanced arteriosclerosis the walls become calcified, that is, calcium salts are deposited in small plates (like pieces of egg-shell) so that when you run the finger along the artery the plates are felt as a series of beads. The artery then feels like a cord and is so rigid that it is described as a "pipe-stem," or is said to be like a "goose's neck." Such an artery may be absolutely incompressible and sometimes little or no pulse can be felt.

The circulation depends to a large extent upon the elasticity of the arteries, so that when this is lacking the whole body must suffer. The health and prolongation of life depend upon the circulation, so that a common saying is that "a man is as old as his arteries." The heart itself will be under a tremendous strain because it has to work much harder to overcome the resistance of the rigid arteries. Normal arteries aid the heart in the circulation of the blood.

Such changes in the walls of the arteries and in the heart will have a marked effect upon the pulse. The downward curve is less gradual than normal, depending upon the degree of rigidity.

In old age the artery falls away rather sharply from the finger and as the pulse in old age is usually slow (the interval being long between the beats), the artery feels "empty" between the beats.

2. **The Tension or Compressibility of the Artery.**—The blood in the arteries is confined "under pressure," the degree of pressure depending to a large extent upon the stretching or tenseness, the relaxation or contraction of the elastic, muscular walls of the arteries. When the muscles are contracted the size of the arteries is diminished so that more resistance is opposed to the flow of blood within them, and it is said to be under tension or pressure—the pressure being the force of blood against the blood-vessels, and the tension, the resistance opposed to it by the arteries. The walls of the large arteries are both elastic and muscular and exert a constant pressure and resistance to the blood within them. The small arteries, the arterioles, are chiefly muscular and are normally in a state of tonic contraction so that they hold back the blood, keeping it under a normal, fairly constant pressure in the arteries and regulating the amount flowing through the capillaries into the veins. By this constant pressure the flow of blood is changed from a jerky, intermittent flow, caused by the heart-beat, to a steady, continuous stream through the capillaries and veins (otherwise the blood would flow during the heart-beat only) and the blood-pressure is kept fairly normal and constant.

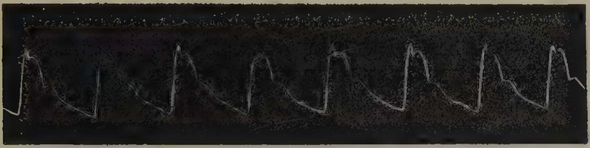

FIG. 13.—SPHYGMOGRAPHIC TRACING OF THE PULSE OF A MAN AGED SEVENTY-FOUR YEARS. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

The Importance of Maintaining a "Normal Blood-Pressure."—Life depends upon a free circulation of blood and the circulation depends upon the fact that there are different degrees of pressure in different parts of the circulatory system—the arteries, arterioles, capillaries and veins. The *pressure is highest in the large arteries* because, being near the heart, they feel the full force of the heart-beat, and being few in number, the space for the flow of blood is limited. The *pressure is less in the small arteries,* and *still less in the arterioles,* because they are more remote from the heart, are less influenced by the heart-beat and because, while they are smaller in size, they are so numerous the blood has more room, and is spread out over a larger area, is not so confined, and is therefore under less pressure. The *pressure in the capillaries is greatly reduced* because, while much smaller than the arteries, they are much more numerous in number, the space over which the blood can spread is so wide it is as though it were flowing from the confined narrow borders of a river into a broad lake. As previously explained, the force of the heart-beat is entirely lost in the arterioles whose muscular walls change the intermittent flow caused by the heart-beat into a steady, constant stream. The heart-beat or the pulse is therefore not perceptible in the capillaries normally. There is no "capillary pulse" except in pathological conditions.

The flow of blood in the capillaries (which are in contact with all the cells of the body) is therefore very slow and continuous, so that the cells are constantly supplied with oxygen and food and waste products are as constantly removed. The nutrition and life of the body depend upon this factor. *The pressure in the veins is still lower* than that in the capillaries. The impulse in the heart-beat has been entirely lost or has been regulated and converted by the arterioles into a steady stream. The veins are also twice or thrice as large as the arteries, giving much more room for the blood and therefore lowering the pressure. In the large veins near the heart the pressure is negative. This difference in pressure can readily be demonstrated by cutting an artery, capillaries, or a vein. When a large artery is cut the blood spurts out in jerks with great force; from a small artery with much less force, from tissues in which the capillaries are cut the blood "oozes" out from the whole surface, and the tissues are said to "weep"; from a vein the flow is steady and continuous with all evidence of the pulse gone. A "venous pulse," like the "capillary pulse," is only present in pathological conditions. It refers to the pulse observed in the large veins near the heart such as the jugular—it gives the beat of the auricles.

The blood naturally flows from a point of high pressure to a point of lower pressure, so that by a constant uniform blood-pressure maintained in the arteries the blood is made to flow from the arteries constantly through the capillaries and veins back to the right side of the heart, so that it can be sent on to the lungs to be purified and back to the left side of the heart to be again distributed to the whole body. The blood must be brought back to the heart, otherwise it cannot be purified and the heart would have nothing to pump on to the arteries.

Anything, then, which interferes with the maintenance of the normal blood-pressure will interfere with the vital function of the heart and with the health of the whole body. It is important to be able to recognize changes in the pulse which indicate an abnormal blood-pressure.

The *blood-pressure* depends upon three factors—the elasticity and contraction or relaxation of the arteries, the volume of blood, and the force of the heart-beat.

The *tension* and the *blood-pressure* can be fairly accurately measured by the force with which the pulse strikes against the finger and the degree of pressure necessary to obliterate the pulse, that is, to prevent the pulse wave from going further along the artery. This is called its compressibility. It is tested by compressing the artery against the bone with one finger and with the other fingers feeling the artery beyond.

The tension and blood-pressure may be "high" or "low."

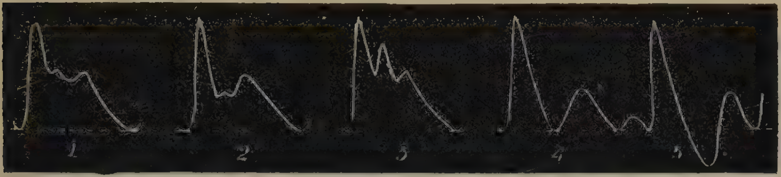

Fig 14.—Diagrams of Pulse. 1. Normal; 2. Low Tension and Soft Pulse; 3. High Tension and Hard Pulse; 4, Soft Pulse Fully Dicrotic; 5. Very Soft Pulse and Hyperdicrotic. (Landois and Stirling.) (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

The Pulse of High Tension or Hypertension.—The tension will be "high" when the arteries are contracted and the heart is beating with some force. All muscles when in a state of contraction feel firm and hard so that the *pulse* of *high tension* feels "hard" to the touch. It is difficult and sometimes impossible to compress a "high tension" pulse. Between the beats it feels "full" and the artery may be felt as a distinct cord which can be rolled over the bone by the fingers.

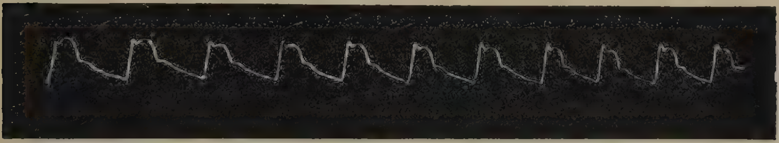

Fig. 15.—Sphygmographic Tracing of a Hard (High Tension) Pulse. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

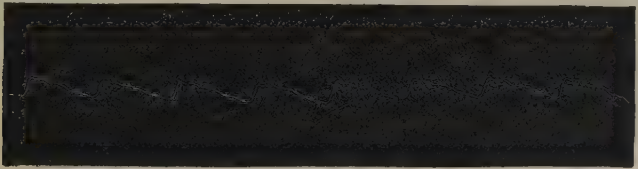

Fig. 16.—Sphygmographic Tracing of a Hard (High Tension) Pulse. (From Cabot's "Physical Diagnosis," Wm. Wood & Co., Publishers.)

The expansion of the artery caused by the upward curve is moderate or low, the downward course is slow and more gradual than normal with little or no dicrotic wave.

The Causes of Hypertension.—Whatever increases the force of the heart-beat and the contraction of the arteries may cause a high tension either temporary or permanent. *Exercise* and *emotions* may cause a temporary increase in tension—sometimes in excitement or anger the vessels may be seen standing out like cords. This must be remembered in caring for a patient with a high blood-pressure or hypertension, because if the vessel walls are diseased even a slight added increase may be sufficient to rupture the vessel in some place such as the brain, where it may be weakest, and cause a fatal hemorrhage. A *cold bath* will also raise the tension because cold stimulates the nerve centers in the brain which causes contraction of the arteries and also stimulates the heart. For this reason "cold tubs" and "cold sponges" are given in typhoid in order to tone up or stimulate the circulatory system—in typhoid the blood vessels are relaxed and the tension is "low." *Chills* and *convulsions* also raise the tension. *Increase in the intracranial pressure* (around or within the brain), due to a cerebral hemorrhage, with pressure from the accumulated blood, or to an increase in cerebro-spinal fluid as in meningitis, or to pressure from a bone in fracture of the skull, raises the tension. *Chronic nephritis*, *arteriosclerosis*, and *exophthalmic goiter* cause a permanent high tension. *Drugs* which stimulate the heart and the contraction of the arteries—caffeine, strychnin, adrenalin, pituitrin—increase the tension and are frequently given for this effect.

It is very important to be able to recognize a "high tension" pulse, for it may be an early symptom of a serious functional disturbance in the kidneys or blood vessels or of some other serious brain lesion.

The Pulse of "Low Tension" or Hypotension.—When the muscular walls of the arteries are relaxed, little resistance is offered to the blood so that the tension and blood-pressure in the arteries are "low." This greatly interferes with the circulation because during diastole, when the blood in the arteries is not being impelled onward by the heart-beat, the relaxed arterial muscles fail to contract and keep the blood moving. The circulation becomes sluggish, the tissues are ill-nourished and clogged with wastes, the blood collects in the veins so that they become congested, less blood returns to the heart to be sent to the lungs to be purified, and as the heart has not sufficient blood to keep the tissues supplied at its normal rate it beats more rapidly, but the beats have less force and may be weak and feeble. In very severe cases so much blood may collect in the large veins that death may result.

Muscles when relaxed feel soft or flabby so the pulse in "low tension" feels "soft" to the touch. The artery is easily compressed, collapses or falls away suddenly from the finger because it lacks tenseness or tone—seems to have no life in it. Between the beats it feels "empty" and the artery can scarcely be felt or even not at all.

The "Dicrotic Pulse."—The dicrotic pulse is a sign of low tension. Figure 17 illustrates a "pulse tracing" in "low tension" —the dicrotic wave (in the middle of the downward curve) is very marked. The upward curve rises "sharp" and "high." The artery strikes the finger quickly and sharply. The downward curve is also sudden, the artery falling away quickly. The pulse may seem strong from the way in which the artery strikes the fingers, but little force is needed to expand the weak, relaxed artery. For the same reason the dicrotic wave is always marked in low tension, particularly when the heart-beat is forceful.

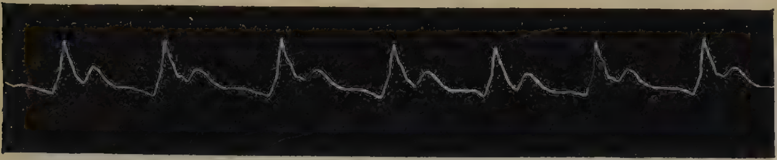

FIG. 17.—SPHYGMOGRAPHIC TRACING OF A SOFT (LOW TENSION) PULSE. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

When the blood is driven into the artery with force and the arterial wall collapses, driving the blood against the closed semilunar valves, the rebound will also come with force against the weak wall of the artery, expanding it so markedly that the dicrotic wave (normally imperceptible) will be quite exaggerated and easily perceptible to the finger. When the tension is low as in typhoid and other acute infections, the dicrotic wave feels like a second weak beat and the pulse is called a "dicrotic pulse." It must not be counted as a pulse or beat.

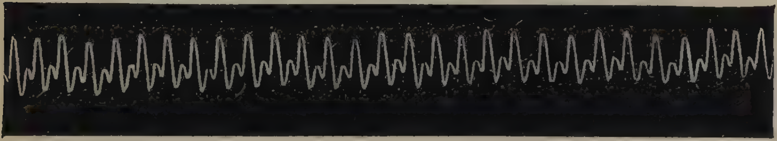

FIG. 18.—SPHYGMOGRAPHIC TRACING OF A DICROTIC PULSE. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

Low tension occurs as the result of anything which destroys the tone and causes dilatation of the arteries. For instance, *food, moderate exercise,* a *warm bath* or *hot pack* will lower the tension. Other causes of low tension are *poorly nourished muscles* of the heart and blood vessels, as in pernicious anemia and *lowered vitality* from any cause; the *infectious diseases*—typhoid, pneumonia and tuberculosis, etc.—in which the toxins poison and weaken the muscles of the heart and blood vessels and also depress the centers in the brain which normally stimulate their contractions; a *severe hemorrhage; surgical shock* or *collapse* in which the vessels are dilated and the blood congested in the large veins; *Addison's disease,* a disease of the adrenal glands in which there is a lessened secretion (adrenalin) which in the normal body aids in maintaining muscular contractions. Certain *drugs*—aconite, amyl nitrite, and nitroglycerin, lower the tension either by depressing the action of the heart or dilating the blood vessels. In high blood-pressure they are used to lower the tension.

Prolonged low tension is very serious so it is important to recognize the pulse in order that methods may be taken at once to raise the tension by stimulating the heart and the contraction of the blood vessels with drugs and treatments.

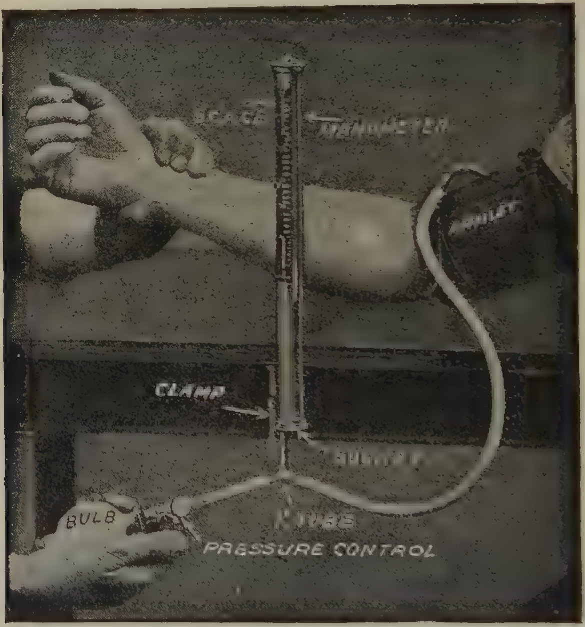

Fig. 19.—Method of Taking the Blood-pressure with Mercer's Type of Riva-Rocci Sphygmomanometer. (From Cabot's "Physical Diagnosis," Wm. Wood & Co., Publishers.)

The *sphygmomanometer* is an instrument for accurately measuring the blood-pressure by determining the exact pressure necessary to compress and obliterate the pulse. There are several forms of apparatus which may be used.

The normal blood-pressure is as follows (Cabot): Systolic (blood is streaming into the arteries) 110-135 mm. Hg.; Diastolic (the arteries are closed off from the heart) 60-90 mm. Hg. The blood-pressure is less in women than in men and lower still in children—90 to 110 mm. Hg. and in children under two years

75 to 90 mm. It is usually higher in old age. In disease, for instance, in nephritis, it may be 200 mm. and more.

3. **The Volume of the Pulse—the Size and Shape of the Pulse Wave.**—The pulse is described as "large," "big," "full" and "bounding," or "small," "feeble," "weak," "flickering," or "thready," depending upon the size of the wave against the finger, in the sphygmograph, depending upon the height of the upward curve. The size of the wave depends upon the force of the heart-beat and the tenseness or relaxation of the arteries. If the arteries are relaxed the pulse wave will be high and the pulse will feel "big," large," or "full," and if also rapid in rate (the beats following each other in quick succession), it is described as "bounding." This pulse occurs in conditions with "low tension." If the arteries are contracted and small, the pulse wave will be "small" and the pulse will feel "small"—in "high tension" ("hard" pulse) the pulse will feel "small" and sometimes so "hard" that it is described as "wiry." When the heart-beat is weak the pulse will feel "small," "weak," "feeble," so that it can scarcely be felt or even not felt at all, or it may be so small as to feel like a little thread, or "thready." This occurs in collapse, after a severe hemorrhage, and frequently when death is near. When the pulse is both feeble and rapid the condition of the patient is always serious.

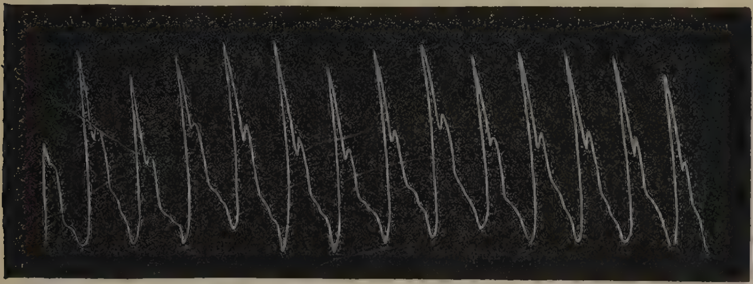

FIG. 20.—PULSE TRACING IN AORTIC REGURGITATION SHOWING ITS COLLAPSING CHARACTER. (From Cabot's "Physical Diagnosis," Wm. Wood & Co., Publishers.)

If the tension is normal, the pulse wave indicates the force and the condition of the heart.

The Shape of the Pulse Wave.—The pulse may be "quick" or "short," that is, the wave rises and falls quickly. The pulse wave strikes the finger quickly, and recedes quickly. This occurs in a "soft" or "low tension" pulse. It is frequently called an "ill-sustained" pulse. It indicates a weakened or diseased heart or weakened blood vessels, or both. It occurs to a marked degree in *aortic regurgitation*, that is, when the valves leading from the heart to the aorta are imperfect and do not close properly so that they allow the blood from the aorta to "leak" back into the left ventricle when the elastic walls of the aorta recoil.

The pulse strikes against the finger sharply and with great force because the heart tries to overcome the defect in its valves and to empty itself completely. On account of the leakage (the blood being able to flow in two directions) the aorta empties itself so quickly, the artery falls away very quickly from the finger and feels "empty" between the beats. This is called the "water-hammer" or Corrigan's pulse. The pulse feels "large," "full" and "quick." It may be observed in the carotid arteries as a sharp rising and falling.

The pulse may be "long" or "slow," that is, it rises slowly and gradually, pauses and falls gradually. This occurs in *aortic stenosis,* in which the valves leading from the heart to the aorta open during systole only sufficiently to allow a small stream to pass through, so that the left ventricle is a long time in emptying itself. This pulse is a "hard," "high tension" pulse.

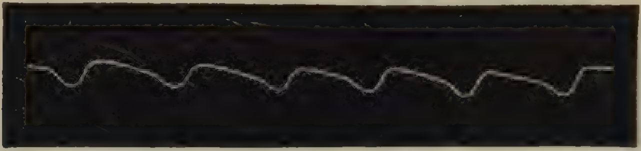

FIG. 21.—SPHYGMOGRAPHIC TRACING OF PULSE IN AORTIC STENOSIS SHOWING INFREQUENT RATE, SMALL PULSE, SLOW RISE AND FALL. Compare with the normal pulse wave and with that of aortic regurgitation. (From Cabot's "Physical Diagnosis," Wm. Wood & Co., Publishers.)

The "dicrotic pulse" wave, the "low tension," and the "high tension" pulse waves have been described.

4. **The Rate of the Pulse.**—(Howell).—The heart lives and works only to supply the needs of the body—the work of the heart is summed up in the heart-beat. These needs vary according either to changes in the conditions surrounding the body or in the condition of the body itself and the heart-beat changes in rate (and force) promptly and unfailingly as the need arises. The pulse is normal only when the mind and body are in a state of rest.

There are wide variations in the normal pulse rate in different individuals which may be peculiar to the individual or may occur in families. For instance, while the normal pulse rate for an adult varies from 70 to 80 beats per minute, in some individuals the normal rate may be 50, while in others the normal rate may be 90.

Variations of the Pulse Rate.—The rate of the heart-beat varies with *sex, size,* and *age.* In man the average pulse rate is 70; in woman 75 to 80. In tall people the pulse rate is slower than in short people of the same age. It has been found that the pulse rate in small animals is higher than in large animals, as illustrated in the following pulse rates: The elephant, 25 to

28; the horse, 36 to 50; sheep, 60 to 80; the dog, 100 to 120; rabbits, 150; mice, 700.

The pulse rate varies with age, gradually diminishing from birth to old age, increasing somewhat again in extreme old age, thus: (Halliburton)

Before birth the average number of pulsations per minute is 150. Just after birth the average number of pulsations per minute is

	from	140 to 130
During the first year	“	130 to 115
During the second year	“	115 to 100
During the seventh year	“	90 to 85
During the fourteenth year (puberty)	“	85 to 80
In adult age	“	80 to 70
In old age	“	70 to 60

In old age the pulse rate is normally slower, therefore a rapid pulse is more serious in the old than in the young. In extreme old age the rate may be increased, 75 to 80, as the action of the heart approaches the condition of infancy, as old age does in so many other ways.

The pulse rate also varies (increasing or decreasing) in response to sensations or messages sent along sensory nerve fibers from all parts of the body to the nerve centers in the brain which control or regulate the action of the heart through the accelerator and inhibitory nerve fibers. The accelerator nerve fibers (from the sympathetic system) increase the rate, while the inhibitory fibers act as the reins which check or slow the rate. Messages are constantly being sent over these wires to which the heart instantly responds so that the needs of the body are met without loss of valuable time. For instance, through these nerves the *emotions*—apprehension, fear, surprise, joy, excitement, anticipation, anxiety, worry, anger—have a powerful influence on the action of the heart. Some people instinctively place their hands over their heart when under the influence of strong emotion caused perhaps by unexpected news whether of joy or sorrow. In pictures and statuary, also, emotion is expressed in this way. Common expressions in our language, “died of a broken heart,” “down-hearted,” “heart jumped for joy,” or “stopped beating with fright,” also show that the effect of the emotions on the heart is a matter of common experience.

Messages are also constantly being sent from internal organs, the stomach and intestines, etc., which have a marked influence on the pulse rate. After meals the pulse is increased both in rate and force. *Messages from the heart* itself are sent along sensory fibers to these nerve centers which in turn regulate it so that in diseases of the heart the heart-beat can be increased in rate and force. Messages are also being sent from *nerve endings in the skin* to the centers which regulate the heart. A cold bath or water “dashed” on the face will first quicken, then slow and steady the heart-beat and raise the tension; a hot bath will quicken and lower the tension. In the same way a mustard paste applied over the region of the heart will stimulate its action. Through these nerve centers and nerves, severe or prolonged *pain* in any part of the body will have a marked effect on the pulse rate.

The rate of the pulse varies with the blood-pressure. When the blood-pressure in the arteries is low the pulse rate increases in order to increase the output of blood and so raise the pressure. Thus in surgical shock in which the blood-pressure is low, the pulse rate is very rapid. When the blood-pressure is high, the rate of the pulse is decreased. In old age the blood-pressure is higher and the pulse rate slower than in youth. These changes are brought about by stimulation of the accelerator and inhibitory nerves regulating the heart.

Exercise increases the rate of the pulse. Even a slight change in position will increase or decrease it. For instance, the pulse when standing may be 80; when sitting 70, and when lying down 66. Heavy muscular work may increase the rate to 150 or 160. If the exercise has been light the pulse may return to normal in a few seconds; if strenuous, long continued and exhausting, it will probably be an hour or more before the rate subsides to normal. The pulse is slower during sleep and repose.

An elevation in temperature causes a rapid increase in the pulse, the rate usually increasing about 10 beats per minute to one degree of elevation in temperature. The temperature and heart-rate rise and fall together, for the rate depends to a large extent upon the temperature at which the heart is working. (In typhoid fever, however, the pulse is low in proportion to the temperature.) The increase in rate is due to the direct influence of the heat upon the heart itself. Heat is one of the best heart stimulants and for this reason it is used both externally and internally when necessary to stimulate a flagging heart. "An increase in heart rate is as much a symptom of fever as is the rise of the temperature, while the pulse-rate in fever is of even greater value for prognosis than is the temperature. No matter how high the temperature, one does not worry so long as the pulse is fairly low; but let the heart rate rise to 140 or over, and the outlook becomes at once more serious."

Some *drugs,* such as caffeine and atropin, stimulate the heart and increase its rate, while others, such as aconite and digitalis, slow the rate.

The pulse rate is also increased in all the acute diseases accompanied by a rise in temperature; in diseases of the heart, in gastric disturbances, in shock and collapse, in exophthalmic goiter (in which there is an over-secretion of the thyroid gland which causes an over-stimulation of the nervous system and the heart), and also in many other diseases. When the heart-beat is very rapid the condition is called *tachycardia* (rapid heart). The pulse is said to be "frequent" when it runs from 100 to 120; rapid, from 120 to 160. When it is above 160 or 170 it is very difficult to count and is described as "running," and the heart is said to be "running away."

When the rate of the pulse is abnormally slow or infrequent the condition is called *bradycardia* (slow heart). A slow pulse usually occurs in exhaustion after severe exercise and in convalescence following acute diseases, in toxemia—auto-intoxication, uremia, and jaundice (bile in the blood poisons and weakens the muscles of the heart); in some cases of hysteria and melancholia; in accidents such as a fracture of the skull causing pressure on the base of the brain; in irritation or pressure on the vagus nerve which slows the pulse rate; in increased intracranial pressure, as in apoplexy and meningitis, and as a result of the action of drugs, such as opium, which depresses the nervous system, and digitalis, which stimulates the vagus nerve and therefore slows the heart-beat.

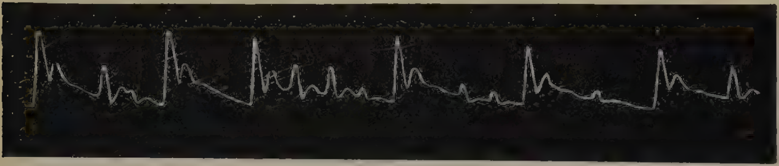

Fig. 22.—Sphygmographic Tracing of an Irregular Pulse. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

All these factors—the influence of the emotions, of exercise, sleep or rest, of exertion and strain (either mental or physical), of digestion or interference with digestion, of exposure to cold or heat (air, water or clothing), of the body temperature, of the blood-pressure and of drugs, etc., on the action of the heart—must be remembered both when taking the pulse and when caring for patients suffering either from a diseased heart or from a disease, such as typhoid or pneumonia, in which the heart is being poisoned and weakened by the toxins or the bacteria and is already under a terrific strain so that any added work will increase the strain, possibly beyond endurance so that death may ensue.

5. **The Rhythm of the Pulse.**—The beats of a normal pulse are almost equal in force and are separated by intervals of almost equal length. In disease the pulse may be irregular in *force* or *rhythm* or, which is more common, in both. *Irregularity in force* means that the beats are not all of equal strength. Some will be strong while others are weak and feeble or scarcely felt at all. Irregularity in force may be temporary, due to over-exertion or to poisoning from the excess use of tobacco, tea or coffee, etc. It is a very serious symptom when occurring in disease of the heart, such as disease of the myocardium or of the aortic or mitral valves, and in diseases of the blood vessels with loss of elasticity or sclerosis.

Irregularity in rhythm means that the intervals between the beats are not all of equal length and the beats do not follow in rhythmical succession. The pulse may be *intermittent,* that is, at regular (every 2, 3 or 4 beats, etc.) or at irregular intervals, a beat is missed. The beat may only seem to be lacking because the heart-beat and the pulse wave are too feeble to be felt by the finger. These beats will be shown by the sphygmograph or may be detected by listening directly to the heart-beats. Inelastic arterial walls easily obliterate feeble heart-beats, or disease of an artery, such as an aneurysm, or external pressure from a tumor, or enlarged organ, or a fractured bone, etc., can prevent the beats from coming through. An *intermittent pulse* is not always serious, as it is quite common in middle age and in the elderly, also in young children, or it may be due to nervousness, indigestion or the excessive use of tea or coffee. It may, however, be due to diseases of the heart. Sometimes the beats come "in twos" or "in threes," and the pulse is called a "bigeminal" or a "trigeminal" pulse. Sometimes, in diseases of the heart, the pulse is very irregular, some beats following each other in rapid succession, while others follow slowly with long intervals between. These long pauses may be filled in by feeble beats which cannot be felt by the fingers. When the pulse is intermittent or irregular in rhythm alone the condition is not so serious as when it is irregular in force. When irregular both in force and rhythm the condition is very serious, as it indicates that the heart is failing. Sometimes the pulse is so irregular that the condition is called "delirium of the heart." Irregularities in the pulse are spoken of as *arrhythmias.*

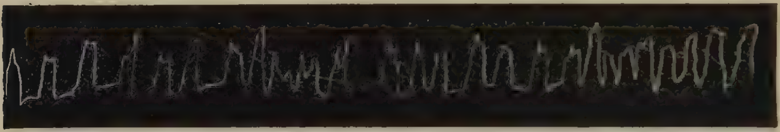

Fig. 23.—Sphygmographic Tracing of Irregular Pulse of a Tobacco User (Waller). (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

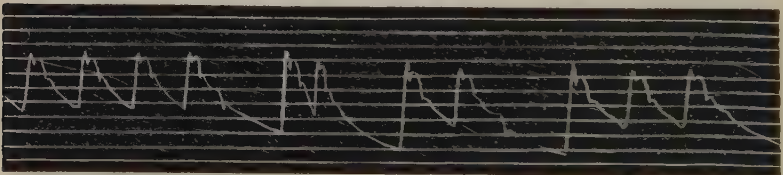

Fig. 24.—Sphygmographic Tracing of an Intermittent Pulse. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

CHAPTER XV

THE CARDINAL SYMPTOMS (Continued)

RESPIRATION

Its Purpose and Vital Importance.—Respiration is the exchange of gases between an organism and its environment, that is, the absorption of oxygen and the elimination of carbon dioxid. It is one of the characteristics common to all living things in one form or another, for it is absolutely essential for the chemical changes of metabolism upon which life depends. Food is also essential but is of no use unless it can be combined in the tissues with oxygen, for only in this way can the combustion or burning of the food take place with the production of heat and the power to do work, both of which are essential to life. The body can survive for a considerable time without food (except that from its own tissues) but not even for a few moments without oxygen.

Oxygen and food are required by each and every cell in the body in order to maintain its life and its function, and they must not only be carried to the little cells, but must actually be absorbed by the cells as the chemical processes of metabolism take place within the cells. Carbon dioxid is one of the universal waste products, resulting from these chemical processes, so that it is equally important that the body be provided with a system which will not only supply the tissues with oxygen but will also rid them of carbon dioxid, otherwise each cell would suffocate or smother to death. When we speak of a person "strangling" or "smothering to death" we really mean that their cells are smothering. The greater the activity of the cell, the more oxygen will be required and the greater will be the amount of carbon dioxide to be eliminated.

Provision for this exchange of gases is made in man by the respiratory and the circulatory systems. By means of the respiratory system oxygen is absorbed into the blood and carbon dioxid is eliminated from the body. (Excess heat and water are also eliminated by means of this system.) By means of the circulatory system the oxygen absorbed in the lungs is conveyed to the tissues and carbon dioxid is conveyed from the tissues to the lungs to be eliminated. Both the respiratory and the circulatory systems are merely a means to an end, the end being the absorption of the oxygen by the cells, together with the chemical processes which follow and the freeing of the cells of the carbon dioxid. Because the cells are so remote from the supply of oxygen there must not only be a means of transporting the gases but respiration, or the exchange of gases, must take place at both ends—between the blood and the air in the lungs, and between the blood and the tissue cells. The former is called *external or pulmonary respiration,* and the latter *internal or tissue respiration.*

In order to understand external and internal respiration and the conditions which may interfere with them, it is necessary to understand the mechanism by means of which they are accomplished.

This understanding may be attained by a study of the anatomy and physiology of the respiratory system as given in the textbook on that subject supplied to students. By this study it will be seen that anything which interferes with the inlet or outlet of air to and from the lungs, as in croup or asthma; or with the free movement of the respiratory muscles, as in convulsions, causing a spasm of the muscles—the patient gets black in the face; or with the functioning area of lung tissue as in pneumonia; or with the amount and quality of the air in the air sacs, or the amount and quality of the blood circulating freely through the capillaries in contact with them, as in heart diseases, etc.; or with the free circulation of blood through other organs of the body, will interfere with the exchange of gases in the lungs and with the supply of oxygen to the tissues, and therefore with the respirations.

The Cause and Regulation of Respiration.—The factors which regulate and maintain the rhythmical movements of respiration are (1) the respiratory center; (2) sensory fibers of the vagus nerve coming from the larynx and lungs; (3) the chemical composition of the blood.

1. *The respiratory center* is situated in the medulla and coincides in position with the sensory center of the vagus. It was called the "vital knot" by its discoverer, Flourens, because he found that when it was destroyed respirations ceased and death followed. This center sends out motor nerves which cause the contraction of the muscles of respiration. It is essentially automatic, that is, it sends out impulses to the muscles independent of any impulses sent to it, but is, however, very sensitive to sensory stimuli from all parts of the body. Sensory fibers travel to it through the vagus from the lungs and larynx. Sensory fibers also travel to it from the cerebrum so that stimulation of any sensory nerves in the body, through the cerebrum, may stimulate the respiratory center reflexly and so affect the rate and character of the breathing. For instance, a dash of cold water on the skin, the emotions, pain, and sensations or messages carried by the nerves of sight and hearing may make the breathing quicker and stronger, or may make it slower and more feeble, or cause it to cease altogether. The facts that nerves travel from the cerebrum to the respiratory center and that the muscles of

respiration are voluntary give one a limited control over the act of breathing (used in singing or speaking, etc.) but under normal conditions the whole apparatus works rhythmically and is purely involuntary. The effort to "hold the breath" is soon limited by exhaustion and by the accumulation of carbon dioxid and the lack of oxygen which it causes.

It is thought by many physiologists that the respiratory center consists of two centers—an inspiratory and an expiratory center, but that in normal, quiet breathing the inspiratory center alone plays an active part.

2. *The Sensory Fibers of the Vagus from the Lungs and Larynx.*—The sensations or impulses from the lung itself which travel to the respiratory center stimulate it and regulate the rhythm of the respirations—the *center starts* the respirations, but the *messages from the lungs regulate* them. This explains why a patient (when the respiratory center is not paralyzed) may often be revived by artificial respirations, that is, by alternately expanding and filling the lungs with air and contracting them and expelling the air by rhythmical mechanical movements.

It is thought that there are not only two centers—one which stimulates and one which inhibits respirations—but that there are separate nerves in the vagus from the lungs—nerves which check inspiration when the lungs are expanded to a certain degree and other nerves which stimulate inspiration when the lungs have returned to their normal size, in this way making the movements rhythmical. In *normal, quiet* breathing, it is thought, however, that the inspiratory center and the nerves which stimulate it only play an active part, while in *forced* or difficult respirations other factors are brought into action.

Stimulation of sensory nerves in the nose, pharynx, larynx, or bronchial tubes, for instance, by injurious gases, dust and other foreign bodies, will check respirations and cause the glottis and bronchial tubes to close in order to protect the lungs.

3. *The Chemical Composition of the Blood.*—The stimulus required to stimulate the respiratory center and make it automatic is the presence of carbonic acid (carbon dioxid in water) in the blood. The activity of the respiratory center is increased in rate and force in proportion to the increase or decrease of carbonic acid. If the blood contains a large percentage of oxygen and a small amount of carbon dioxid, the respirations will be feeble and may stop altogether. Carbon dioxid, then, is the *normal stimulus* to the respiratory center.

The respiratory center starts the respirations, the nervous stimulus through the vagus from the lungs maintains the rhythm and the chemical stimulus (carbon dioxid in the blood) regulates the rate and depth of the respirations.

Normal Respirations or Breathing.—Normal breathing consists in a rhythmical rising and falling of the chest wall and of the walls of the abdomen occurring in an adult about 18 times per minute and carried on unconsciously, without effort, sound, or pain.

The Method of "Taking" the Respirations.—As in taking the pulse, the patient should be at rest both mentally and physically. Allow the effect of exertion and all mental excitement or nervousness to subside, for these will increase the rate and alter the character of the breathing. Even the consciousness of being watched will cause an involuntary change in the rate and rhythm, so the respirations should be counted without the patient's knowledge. After counting the pulse, with the fingers still on the wrist as though still engaged in counting the pulse, watch the rise and fall of the chest or upper abdomen, or if it causes no discomfort to the patient, when counting the pulse allow the patient's arm to rest lightly on the lower thorax so that after counting the pulse and without watching the patient you can feel the chest and abdomen rising and falling. In this way you can count the respirations without the patient's knowledge. Sometimes you may count from hearing them distinctly. Count for one minute. There are certain characteristics to be noted, however, which can only be observed by watching the movements of the chest and abdomen.

What to Observe when Taking the Respirations.—A nurse must observe the rate and character of the respirations, the movements and expansion of the chest and abdomen, the color of the patient, and the position he may instinctively assume.

1. The Rate of the Respirations.—The average rate for a healthy adult is from 14 to 18 per minute, but it is greater in childhood (20 to 25) and in infancy (30 to 40). In health there is a uniform relation between the frequency of the pulse and of the respirations in the proportion of one respiration to four or five pulse beats. In health the respirations increase in rate and force under the same conditions as the heart to meet the needs of the body, but in disease this relation may cease. The respirations are usually increased with the pulse, but not always in equal proportions. In diseases of the lungs and air-passages the respirations may increase in much greater proportion than the pulse, while in other diseases (and this is more common) the pulse increases in greater proportion than the respirations.

Conditions which Cause an Increase in the Rate or Depth, or both, in the Respirations:

(a) *Conditions which directly or indirectly (messages which travel to and from centers in the cerebrum to the respiratory center) stimulate the respiratory center.*

The *emotions* have a marked effect on the respirations. Nervousness or excitement may increase the rate to 60 per minute, but the breathing will be full, easy and painless. In other cases nervousness may slow the respirations—a long, sighing breath occurring every minute or so is characteristic of certain neurotic conditions. *Sighing* is a modified form of breathing, usually indicative of grief; the "heaving chest" may indicate grief or anger; "gasping," surprise or terror. A cold bath or a *"dash of cold water,"* by stimulating nerve endings in the skin and indirectly (or reflexly) stimulating the respiratory center will first make one gasp, then the breathing becomes fuller and deeper. *Heat,* a hot-water bath or steam inhalations, will in the same way increase the rate and ease of the respirations, but makes them more shallow. These treatments are therefore used to relieve croup and asthma. *Slapping the surface of the body,* a hot bath with or without mustard, are methods used to stimulate the respirations in new-born babies. They stimulate the nerve endings in the skin and reflexly the respiratory center. *Pain* in any part of the body frequently causes increased respirations—the impulses from the irritated nerve endings are first carried to the cerebrum, then to the respiratory center. This may be seen in pleurisy, pneumonia, peritonitis, or in any condition causing severe pain. Sometimes, however, pain slows the respirations. *Toxins,* present in the acute infections and in uremic poisoning, etc., directly stimulate the respiratory center and increase the rate of the respirations. The *heat,* or elevated temperature, present in the acute infections, also increases the rate because the heat stimulates the heat-regulating centers which set about getting rid of the excess heat, one means being by increased respirations. *Cerebral affections* which stimulate the respiratory center cause an increased rate in respirations. Certain *drugs,* such as atropin, which directly stimulate the respiratory center, increase the rate.

(b) *Conditions affecting the circulation which cause an increased rate.—Pneumonia* and other inflammatory diseases of the lungs which cause congestion and consolidation of the lung, thereby limiting its functionating area and also interfering with the circulation, will greatly interfere with the exchange of gases and cause an increased rate to make up the lack of oxygen; the accumulated carbon dioxid also causes an increased rate. *Heart diseases,* nephritis, and other conditions which interfere with the circulation interfere with both internal and external respiration. The respirations are increased in order to meet the demand for oxygen and to get rid of the carbon dioxid. *Hemorrhage,* in which the volume of blood is lessened so that there are not enough red cells and hemoglobin to carry the oxygen so that the tissue cells are strangling to death; *shock,* in which a large volume of blood is congested in the large abdominal veins instead of circulating through the lungs, will have the same effect as an actual loss of blood—the respirations will be rapid and sighing.

(c) *Conditions affecting the composition of the blood which cause an increased rate.*—Conditions which *increase the amount of carbonic acid or other acids;* conditions which *greatly reduce the amount of oxygen* or which *increase the demand for oxygen* will cause an increased rate in the respirations in order to get rid of the carbon dioxid and supply the oxygen. *Increased carbonic acid* directly stimulates the respiratory center; *other acids,* such as are present in acidosis, likewise stimulate the respiratory center. *Increased metabolism* in the body from any cause demands more oxygen and causes an increase in carbon dioxid; *toxins* in the blood increase the rate not only because they directly stimulate the respiratory center but because they increase tissue destruction or metabolism. *Exercise* and all forms of exertion or muscular work demand more oxygen and cause an increase in carbon dioxid; exercise and muscular work also increase the amount of other waste products, such as lactic acid, and this, as well as the carbonic acid, directly stimulates the respiratory center. In *anemia* there is a reduction of red cells and of hemoglobin and so a great decrease in the oxygen carrying power of the blood; in *poisoning from gases,* such as carbon monoxid, there is a marked decrease in the supply of oxygen to the tissues because hemoglobin combines more readily with this gas than with oxygen and so becomes saturated with it and is unable to carry oxygen: The small amount carried in the plasma is all that the tissues receive. Respiration must be more rapid in the effort to supply the deficiency.

(d) *Changes in the atmospheric pressure which increase the rate.*—In high altitudes such as are encountered in balloon ascensions or in high mountains, the pressure of oxygen in the atmosphere is very low so that there is not enough absorbed into the blood. The result is "mountain sickness," characterized by great weakness, and "air-hunger" because the cells have not enough oxygen to perform their work and are strangling to death. The normal amount of oxygen in the air is 20 per cent. and this is ample to meet the body needs and allows a sufficient margin of safety. When the amount is reduced to 10 per cent. this margin of safety is removed. In high altitudes there is only a slight margin of safety. Lack of oxygen, besides interfering with the life processes of the cells, produces poisonous substances in the blood—products of incomplete oxidation—which directly affect the brain.

When the pressure of oxygen is higher than normal the result may be dangerous because injurious to the body tissues. Animals die of convulsions when exposed to a high pressure of oxygen. The results of too much oxygen are seen in caisson disease. Great care must therefore be taken when administering oxygen to a patient, to supply a lack of oxygen, to regulate the pressure. The gas first passes through a flask of water in which you can see the bubbles of gas and so can estimate and regulate the pressure of the oxygen administered to the patient.

(e) *The Body Temperature.—A high body temperature,* as stated previously, will increase the rate of respirations as a means of eliminating the excess heat. A high body temperature will also increase the metabolism in the body. It causes increased destruction of body tissue and emaciation. The hemoglobin gives up its oxygen more readily. Oxidation processes are also stimulated, increasing a demand for oxygen and increasing the amount of carbon dioxid.

A Low Body Temperature.—The oxyhemoglobin readily gives up its store of oxygen to the tissues only at body temperature. If the temperature is subnormal the oxyhemoglobin will not give up its oxygen readily, and the tissues will not be able to carry on their functions.

(f) *Mechanical interferences with the breathing which cause an increased rate.*—These also cause a change in the character of the respirations, in the action of the muscles, the movements of the chest and abdomen, and in the position of the patient. Examples of mechanical interference are: (a) Obstruction to the air passages from a foreign body or increased secretions as in croup or bronchitis; edema or swelling of the tissues around the glottis, a stricture of the glottis, or a spasmodic contraction of the muscles of the glottis in each case narrowing the passage; (b) Contraction of the muscles of the bronchial tubes as in asthma, narrowing the air passage; (c) Paralysis of the muscles on one side (hemiplegia) so that the lungs on that side cannot expand; (d) Fluid in the pleural cavity (as in pleurisy with effusion) or air in the pleural cavity will limit the motion on that side and increase the expansion of the other side; pleural adhesions, in old pleurisy or tuberculosis, which bind the lung down, will also prevent expansion and limit motion on the diseased side. (e) An enlarged liver or spleen will prevent the diaphragm on one side from contracting and so will prevent expansion of the chest on that side. Rigidity of the abdominal muscles as in peritonitis will prevent the descent of the diaphragm. The presence of fluid in the abdomen (ascites), a tumor, dilated stomach or distention (gas in the intestines) will push the diaphragm upward so that it cannot descend and the work must be thrown upon the thoracic muscles; (f) Diseases of the lungs, such as pneumonia, tuberculosis and emphysema, which limit the functioning area for the exchange of gases: In pneumonia, the lower lobes may be consolidated so that air cannot enter or the lung expand: In tuberculosis, the apex of the lung will fail to expand and the normal lung will have to expand more freely and do more work.

In all the above cases where the function of a part of a lung, a whole lung, or both lungs is interfered with the respirations will be more rapid in order to supply sufficient oxygen. In health the abdominal breathing is most pronounced, while in forced or difficult breathing the costal type is marked. In certain diseases there may be an exaggeration of one or the other. In the above cases where the normal descent of the diaphragm is prevented costal breathing will be more marked.

Conditions which Cause a Decrease in the Rate.—Any condition which causes an *increase in the intracranial pressure* will depress the respiratory center so that the breathing will be slow or it may be irregular. The pressure may be due to a tumor or to a cerebral hemorrhage, as in apoplexy, or to pressure from a bone in fracture of the skull, or it may be due to an increase in the cerebrospinal fluid, as in meningitis.

In *diabetic coma* and *uremic coma* the respirations are slow or irregular and stertorous, due to exhaustion and failure of the respiratory center. At first the poisonous products of metabolism in the blood stimulate the respiratory center, making the respirations more rapid, but when the stage of coma develops (produced by the poisonous substances) all the centers of the brain, including the respiratory center, are depressed and exhausted. Toxins and drugs such as atropin and strychnin, etc., which stimulate, will, through exhaustion, finally depress the respiratory and other nerve centers.

Certain *drugs*, particularly opium and the preparations of opium, depress the respiratory center and slow the respirations. In poisoning from opium the respirations may be depressed to a dangerous degree. In pneumonia when opium is given to relieve delirium and to induce rest and sleep, the breathing must be watched very closely because opium depresses the respiratory center, which is already becoming exhausted from the effects of the toxins and high temperature.

If the respirations are decreased to below 8 or increased to above 40 the outlook is very serious.

2. The Character of the Respirations.—Respirations are described as "deep" or "shallow," depending upon whether the volume of air inspired and expired is greater or less than normal. "Rapid" respirations are usually "shallow." Whatever interferes with the proper expansion of the chest, or with the inlet or outlet of air, or with the functioning area of the lungs, will decrease the volume of air inspired or expired. For instance, in pain due to pleurisy the patient will take quick, shallow breaths in order to limit the expansion of the lungs so as to prevent the irritated pleural membranes from rubbing together. The *position* of the patient is also an important diagnostic factor: He will lie on the affected side so that the pressure of the bed will prevent expansion on that side and also so that the other unaffected side will have unlimited room for expansion. In pneumonia, tuberculosis and other diseases of the lungs, the breathing will be shallow and the patient usually lies on the affected side to allow the other lung free expansion. In *pain* due to peritonitis, when every movement causes more pain and irritation, the patient instinctively holds the diaphragm and the muscles of the abdomen rigid and takes quick, shallow respirations in order to protect and prevent irritation of the inflamed tissues within. The respirations are usually shallow in conditions of marked prostration in which all the vital centers are depressed and exhausted.

"Deep" respirations occur usually in the same conditions which give rise to slow breathing so that the respirations are "slow" and "deep" in all conditions which give rise to increased intracranial pressure, and also in diabetic and uremic coma.

Dyspnea means difficult breathing—*dys* comes from a Greek prefix meaning bad or difficult and *pnœ* which means breathing. This condition resembles the "breathlessness" or being "out of breath" which we have all experienced from climbing several flights of stairs rapidly or from running a distance to "catch a car," but instead of being temporary and of short duration it continues hour after hour and day after day.

The respirations are almost always rapid and deeper and are usually accompanied by pain. Every breath is quick and labored, performed with great difficulty and only after a hard struggle so that the patient is exhausted with the prolonged effort. Dyspnea is caused by an increase of carbon dioxide and a decrease of oxygen in the blood resulting from incomplete metabolism —as stated previously, carbonic acid and the acids resulting from prolonged exercise, or which occur in acidosis, powerfully stimulate the respiratory center and increase the rate and depth of the respirations. It occurs therefore in all those conditions already mentioned which cause an increase in the carbon dioxid, or a decrease and a demand for oxygen, and in diabetic acidosis—the "air-hunger" of diabetes.

The *symptoms* are rapid, labored breathing, with a distinct, audible sound; the lips are usually blue or a dusky color; the face has a distressed, anxious expression; the eyes are prominent; unusual muscles are forced into action; the nostrils dilate; the upper part of the chest is greatly expanded by the action of muscles at the sides of the throat (the sternocleidomastoids) attached to the sternum, clavicle and mastoid bones; the diaphragm contracts with force and the abdominal walls protrude, so that each breath is drawn with "heavings" of the chest and abdomen. Frequently the dyspnea is so severe that the patient can only breathe when sitting up and so is obliged to sit up night and day. This condition is called *orthopnea.* Both the dyspnea and position are extremely exhausting; the patients are most pathetic and require the very best nursing care. The patient usually leans forward (to be free of the pressure of the bed) supporting the weight of his shoulders with his hands or arms resting on the bed or table, because in this position all the accessory muscles of respiration can work to better advantage.

When the dyspnea is prolonged and severe and the patient weak and exhausted, the action of the respiratory muscles becomes more pronounced and the breathing is frequently irregular and gasping. The forceful contraction of the diaphragm draws the sternum and ribs downward and inward, seeming to "suck" them in so that a marked depression and groove is formed at each inspiration in the front and lower border of the chest. Normally this is prevented by the pull of other muscles attached to the sternum and ribs. Sometimes also the action of the sternocleidomastoid and the trapezius muscles becomes exaggerated so that at each inspiration the upper part of the chest is elevated, the head is drawn back, the chin being thrown quickly upward. During expiration the head falls forward and the chin slowly falls so that each inspiration is accompanied by a nodding or rocking movement of the head. These symptoms are of very grave significance and indicate the near approach of death.

Dyspnea may affect inspiration or expiration or the whole act may be a struggle.

Inspiratory dyspnea is usually due to spasm or to obstruction in the air-passages, as in croup, edema of the glottis, diphtheria, and whooping cough. It gives rise to a very characteristic sound—high-pitched, crowing, harsh, and grating (stridulent breathing) and the whoop in whooping cough. In coma, apoplexy, or profound unconsciousness from any cause, each inspiration may be accompanied by a loud, snoring sound and the cheeks puff out at each breath. This is called stertorous breathing and is due to the vibrations of the relaxed soft palate.

Expiratory dyspnea occurs in asthma and in chronic bronchitis. In asthma the air seems to enter rather easily but a spasmodic contraction of the bronchial muscles narrows the tubes so that expiration is painfully prolonged and "wheezing." In bronchitis the tubes are partially closed and contain secretions so that the sound is "wheezing" and the rattle of bubbles (air in fluid) may be heard all over. In diseases of the respiratory tract, near approaching death, when the fluid in the trachea and bronchi is abundant, this rattling, bubbling sound may be heard at a distance, and is spoken of as the "death-rattle." In pneumonia the breathing is shallow, difficult and painful, and each expiration is made with a characteristic "grunting" sound of discomfort. It is really a little moan from pain.

"Sighing" and "yawning" respirations occur when the cells are smothering for want of oxygen, as in severe hemorrhage, in which sighing, shallow respirations are an important symptom. When the demand is very great the condition is called "air-hunger," in which the patient is very restless, gasping and fighting for air. The air-hunger in diabetic coma is due to the exhaustion of the respiratory center. The respirations are full and deep.

Dyspnea is usually accompanied by cyanosis, a blue or dusky hue to the skin due to the fact that the blood flowing through the vessels of the skin is venous in character instead of arterial. This is easily understood when it is remembered that the dyspnea is due to the increase in carbon dioxide and the decrease in oxygen, the presence of which with hemoglobin gives the arterial blood its red color. This dusky hue may be noticed first about the lips and in severe cases in the extremities under the nails, and finally over the whole body.

Cheyne-Stokes Respirations.—Dyspnea means difficult breathing in which the respirations are usually rapid, deep and noisy. *Apnea* means absence of or a complete cessation of breathing.

Dyspnea occurs when there is a marked increase of carbon dioxid and a decrease of oxygen in the blood. Apnea occurs when there is an increase of oxygen in the blood and a decrease of carbon dioxid and therefore of the normal stimulus to the respiratory center. Cheyne-Stokes respirations (called after the two men who first described them) consist of periods of dyspnea preceded and followed by periods of apnea and occurring in a rhythmical cycle, each paroxysm lasting from thirty to sixty seconds. The period of dyspnea begins with short, shallow respirations, almost imperceptible, but each respiration increases in rate, depth and sound until a maximum of dyspnea is reached, when they gradually decrease in rate, depth and sound, until they finally cease altogether and the apneic period begins. (In children usually there is no gradual decline but the maximum of dyspnea ends with a long-drawn sigh followed by a period of apnea.) It may last from one to ten seconds when the whole cycle will begin again. During the period of apnea the patient may drop off to sleep for a few seconds, but during the period of dyspnea even though asleep, he is apt to be restless.

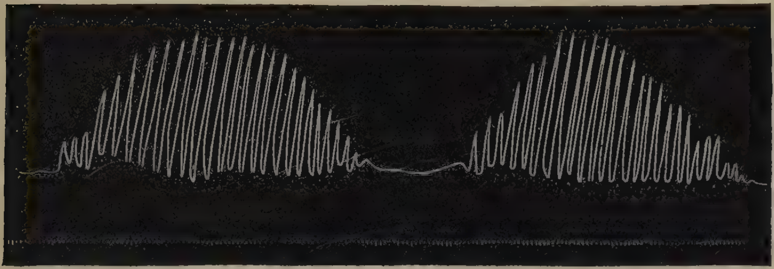

FIG. 25.—STETHOGRAPH TRACING OF CHEYNE-STOKES RESPIRATIONS IN A MAN. The time is marked in seconds. (From Kimber's "Anatomy and Physiology," Macmillan Co.)

While Cheyne-Stokes respirations may occur in healthy children and in healthy adults when asleep, particularly when lying flat on the back, in disease it is always a very grave symptom. Patients have recovered in whom this grave symptom has been marked, but in acute illness Cheyne-Stokes respirations are usually regarded as a sign of approaching death. They occur in conditions in which the respiratory center is almost exhausted and too weak to be stimulated by the usual amount of carbon dioxid in the blood. During the period of apnea an abnormal amount of carbon dioxid is allowed to accumulate, sufficient to stimulate the failing center; during the periods of dyspnea the respirations are so rapid and deep a large amount of oxygen is accumulated and the respiratory center rests, breathing ceases, until again stimulated by a sufficient amount of carbon dioxid.

This form of breathing is most common in severe heart diseases, uremia and in cerebral diseases with increased intracranial pressure. It occurs in tuberculous meningitis either in its typical or in a modified form.

Too much emphasis cannot be placed upon the careful observation of the respirations—the rate and character, the position of the patient, the movements and expansion of the chest and abdomen. No one but a nurse, not even a doctor, is in a position to make these observations to the best advantage. A nurse may observe the patient during night and day, asleep or awake, and during her many duties in the care of the patient, who is apt to be more natural, less conscious, and more "off her guard" with the nurse than during the often unexpected, or anxiously expected and often hurried visit of the doctor.

The temperature, pulse, and respirations are the three cardinal or "vital symptoms." They each indicate the condition of vital organs in the body and are the chief means of finding out the patient's general condition. To read these important signs accurately requires knowledge, study, and experience, with close and accurate observation. Taking note of these symptoms may be a means of saving the patient's life, whereas ignorance, thoughtlessness, or neglect may cause the loss of valuable time in treating the patient, which may mean loss of life which might otherwise have been saved.

The Temperature, Pulse and Respirations During Infancy

The degree of body temperature during infancy and childhood is of tremendous importance as an indication of health or disease and is an important guide in the treatment and nursing care.

How Infants Differ from Adults.

1. The normal rectal temperature varies from 98° to 99° F. It varies much more in infants than in adults because the body temperature is much more readily affected both by conditions within and without the body. An infant in this respect more nearly approaches a cold-blooded animal which has about the same temperature as the medium with which it is surrounded. This is because the heat-regulating centers in the brain and the whole nervous mechanism which maintains a proper balance between the production and elimination of heat (the normal body temperature) are not nearly so stable as in an adult. Heat elimination does not keep pace so readily with heat production and heat is often not so readily produced in the body to make up for that lost.

2. Infants must *sleep* a great deal and during sleep less heat is produced. For this reason particular care must be taken to see that they are kept warm while asleep.

3. Again, infants, particularly young infants, are inactive, so do not produce so much heat in this way. They exercise by crying, waving their arms and legs about, grasping at things and

trying to get up, etc. The child's clothing and bedclothes, etc., must allow for sufficient exercise as it is not only a means of producing heat, but of developing muscular strength and growth. Their position should be changed and they should be taken up several times during the day. Just as inactivity may lower the temperature, overactivity, as in convulsions in an infant or overexertion in the boisterous play of a young child, may cause a rise in temperature.

4. Infants also lose relatively more heat by radiation than adults because their skin surface in proportion to their size is relatively greater than in an adult. More blood is thus in contact with the surrounding medium. For this (and the reasons mentioned above) an overheated room or excessive clothing may cause fever in an infant, and exposure to cold or chilling may cause the temperature to fall below normal, particularly in very young or very weak infants. *A subnormal temperature in infants is much more important and serious than in adults.* Special care must be taken to avoid exposure to drafts or to cold while feeding, bathing or giving treatments to infants. They must be kept warmly wrapped in a soft warm blanket, and bathed, etc., near the radiator or an open fireplace if available. The head and chest must be protected because infants are very susceptible to respiratory diseases; the feet must be warm because cold feet cause congestion in the head and chest which predisposes to respiratory diseases. Cold feet also cause colic. The abdomen must also be well protected to avoid chilling the intestines, and causing colic and congestion of other abdominal organs. Abdominal bands are applied for this purpose as well as for other reasons. When the temperature is subnormal, as it is apt to be in premature babies, or poorly nourished and very weak infants, external heat must be applied in order to raise the temperature to normal in order to maintain life. These infants must on no account be removed from the source of heat or exposed to cold in any way. In summer, on the other hand, excess clothing should be avoided.

5. The above reasons also explain why children react so readily and why particular care must be taken in such treatments as hot baths for stimulation or convulsions, etc., and cold sponge baths or cold rectal irrigations for the reduction of temperature, etc.

6. Conditions within the body also affect an infant much more readily than an adult. Diarrhea may quickly lower the temperature by abstracting heat from the body. A subnormal temperature is to be watched for and guarded against. Lack of fluid in the body, a slight digestive disturbance or a mild infection which would not affect (or only slightly so) the temperature of an adult may cause a high fever in an infant. Infants stand a high temperature better than adults. Fever lasting a few hours does not cause much anxiety, but if continued, it indicates that something is wrong, and that the condition may be serious.

A rise in temperature, however slight, if continued, should never be ignored.

All the above factors emphasize the importance of the care of the skin, the protection from cold, the proper diet, amount of clothing, exercise, fresh air and sunlight and explain why personal hygiene is one of the greatest factors in the nursing care of infants and children.

Method of Taking the Temperature of an Infant.—The temperature of an infant or young child should always be taken by rectum as it is the most reliable. There should be a separate thermometer for each infant. The thermometer should be well lubricated before insertion. If an infant struggles while taking the temperature turn it on its face or hold it face downward on your knee. With the child in this position, after insertion point the thermometer downward toward the umbilicus so as to follow the curve of the rectum.

Never leave a young child alone with a thermometer inserted.

The **pulse** and **respirations** during infancy are not nearly so significant as the temperature. As a rule no record is kept on the chart during the first year of infancy. Infants are restless, the tension of the pulse is lower than in adults, and the rate is difficult to count accurately. Nurses, however, should carefully note the character of the pulse and respirations in all diseases (such as those of the respiratory tract, the acute infections or congenital heart disease) likely to affect the pulse or respirations.

The rate of the pulse and respiration both vary with age. In both, also, very slight causes produce wide variations due to the unstable nervous system.

At birth the pulse varies from 120 to 150 per minute; at the end of the first year from 120 to 110; in the third or fourth year it falls to 100 and continues to fall gradually until the age of puberty, when it is the same as the adult pulse.

At birth the respirations vary from 30 to 60; in the first year from 25 to 30; in the fifth year from 22 to 25, and in the fourteenth year are about 20.

CHAPTER XVI

ELEMENTARY NURSING IN THE PREVENTION AND CURE OF MEDICAL DISEASES

The Care of the Mildly or Chronically Ill, and Convalescent Patient

Opportunities for Serving and Learning.—In the care of medical diseases there are infinite possibilities and constant demands for the exercise of all the patience, sympathy, knowledge, and skill which a nurse may possess or acquire. For in the treatment of medical diseases—inflammatory and functional disorders of the heart, lungs, kidneys, stomach, glands, joints, etc.,—the nursing care is always an important factor, while, in such diseases as pneumonia, typhoid fever, rheumatism, heart disease, and diabetes, the recovery of the patient depends, perhaps, more upon good nursing than upon any other factor. In the care of some diseases, an eminent doctor has said, "that a good nurse without any doctor is better than the best doctor without any nurse." To provide the patient with fresh air, proper food, rest, sleep, and comfort will, alone, go far toward helping Nature to overcome the disease, and these the youngest student nurse may share in providing, and in helping the patient to acquire proper health habits. No quick and miraculous treatment like an operation, as in surgical diseases, exists which quickly brings the patient out of danger and sends him on the road to recovery. Complete recovery is usually a long, slow process, so the patient is much more apt to suffer both mentally and physically from the long, unnatural confinement in bed and the departure from a normal active life. Family, social and economic problems arise which require attention, and which impress upon us the rôle of these social and public health aspects in relation to both the cause and the effect of disease.

Students are given experience in the care of patients in medical wards because of the special knowledge, special skills, special appreciations, attitudes of mind and character traits which can best be learned and developed here and which are essential in nursing. The treatments prescribed by the doctor—the application of mustard pastes, a hot-water bag, fomentations, an ice-cap, poultices, baths, packs, and sponges, etc.—are all carried out by the nurse and their effect on the patient will to a large extent depend upon her knowledge and skill in giving them. In nursing in medical diseases a nurse must be keenly alert to observe every symptom and to note the effect of each treatment, for the doctor is not there to note its effect, and treatments will be continued or altered according to their effect on the patient.

Whatever appeals in nursing,—whether it be the ideal of service, or an interest in science, in people, and in disease, or the fascination of a busy, varied, active life, or the desire to become a skilled, well-informed and well-equipped nurse—may all be gratified in the care of patients suffering from medical diseases.

Young student nurses may serve and share in this valuable experience by caring for convalescent patients, for those not acutely ill, and by assisting older nurses in the care of patients who are acutely ill.

Nursing the Convalescent and Chronically Ill Patient.—While the care of the convalescent patient does not require as much technical knowledge and skill as during the period of acute illness, nevertheless it is an art requiring its special knowledge and skill and particularly a health point of view. The acute illness is like a battle—patient, doctor, and nurse are combating disease. Convalescence is a period of reconstruction, of upbuilding. The doctor and nurse are builders. Sometimes an experienced doctor or nurse may be preëminently successful during the period of acute illness but not so successful during convalescence. They fail through lack of interest, or proper point of view, or through lack of training or appreciation of the knowledge and skill required. They play their part as warriors but not as builders. The needs of the patient have changed but the nurse has remained the "sick nurse" whereas the patient needs a "health nurse" to help build up his physical strength and to foster returning interests, hopes and plans for a future happy, useful life. Nurses and doctors should be builders as well as warriors in the battle against disease. And the battle should also be one of offense (prevention) as well as defense (cure). The young student nurse with her many interests, zest for life, hopes and dreams for the future, unclouded by the sad experience of human suffering and the hazards of life, can be, with proper instruction, of particular service during this period of upbuilding and in sustaining the mind and body of the convalescent or chronically ill in their long struggle for health.

The Care of the Convalescent or Chronically Ill Patient.—Among the treatments for which students may be responsible are the following: (1) *Rest*—local and general; (2) *Position* (local and general), and *Pressure;* (3) *Local applications of dry and moist heat;* (4) *Local applications of cold;* (5) *Local applications of simple chemical counter-irritants.*

Art or Skill Dependent upon Knowledge.—It is important to remember that nursing, while an art, is not just a procedure or series of procedures, but that it is an art which must be directed and controlled by knowledge and science. It is a *means* to an *end*—to certain definite therapeutic results. Before we can intelligently and safely apply the above treatments we must have knowledge of the following:

1. The pathological condition or lesion to be relieved.
2. Their purpose and the effects they are intended to produce.
3. The physiological action of the agent applied.
4. The underlying principles and method of procedure in order to get the best results and the symptoms to be observed.

Inflammation the Pathological Lesion in Nearly all Diseases.—It will be seen by referring to Chapter XX that inflammation is the pathological lesion present in nearly all diseases and that the treatments discussed are all applied to modify some stage of this process or to relieve symptoms arising from it. *An understanding of an inflammatory process is therefore the key, essential to an understanding of the treatments and the diseases they are intended to relieve.* Without this, nursing is mere mechanical routine, neither intelligent nor safe.

REST

We have all, no doubt, observed that when the body is sore or painful in any part, Nature instinctively protects that part by using it as little as possible. For instance, with a blister on the heel we limp, making the well foot do all the work, and with a toothache we masticate on the opposite side. A patient with a stabbing pain in the side, as in pleurisy, will hold his hand firmly over the part, and when in bed will lie on that side, taking short, shallow breaths to prevent expansion or use of that lung and friction of the pleural layers. With pain in the abdomen a patient will draw up his thighs to relax the abdominal muscles and keep the viscera at rest. With rheumatism in the hands, the fingers and wrists are bent to relax the muscles and so prevent them from pulling on the painful joints. If the rheumatism and pain are not relieved the joints become fixed in this position and the part will be permanently deformed. Many similar examples might be given to show that the body instinctively tries to lessen the amount of work in a diseased or injured part in order that the tissues may devote all their energies to defense and repair of the damage. Movement or use, irritation or stimulus of an inflamed part—the eyes (by light), joints, wounds (by dressings), stomach or intestines (by peristalsis)—depending upon the condition and location, will increase the blood supply, spread the infection, break down adhesions, interfere with the formation of new tissues and so with the healing process. Rest, both local and general, is, therefore, the first treatment prescribed by the doctor and the first essential in the nursing care.

A nurse must remember, however, that while a patient instinctively assumes a position which rests an injured part, that position will itself become a source of discomfort if not relieved by support of some kind. For instance, if a patient has sciatica and every movement causes pain, he will flex his thighs, or if he has an abdominal operation and every movement seems to tear open the wound, he will also flex his thighs. This position, instinctively assumed, must be supported in order to relieve the strain on other muscles. Pillows or other means of support should be properly adjusted and rearranged from time to time.

Examples of Treatment by Rest.—In fractures, movement and pulling or straining of muscles are prevented by the use of splints, casts, sandbags, slings or pillows. In myocarditis, the heart muscle is rested by the application of an ice-bag and by keeping the patient in bed, thus lessening the demands on the heart. In nephritis, the kidney is rested by giving a "low protein" and a salt-free diet, in this way lessening the work of the kidney by lessening the waste products to be eliminated. In diseases or operations on the alimentary tract, peristalsis is lessened and the part is rested by a restricted diet. In dry pleurisy when each respiratory movement causes severe pain, due to the friction of the inflamed visceral and parietal layers of the pleura, the lung is immobilized by "strapping the chest." (See Figure 95.) In diseases of the eyes, they are protected from light. Mucous membranes are protected by soothing ointments.

POSITION AND PRESSURE

Now the same may be said about position. The body instinctively assumes the position which lessens pain or discomfort. As we have seen, rest and freedom from pain in a part are often secured by assuming certain positions. Many other illustrations may be recalled. For instance, some of us, when our feet are tired, swollen and painful, have the unladylike habit of elevating them on a convenient couch or stool. With a headache or earache we hold and press our hand to our head, or to our cheek with toothache. We lie down when we feel faint. We sit up in bed if we have difficulty in breathing from coryza, etc. In all these cases there is congestion of blood in the veins or an exudate in a cavity causing pressure on nerve endings, and we instinctively attempt to regulate this by position and pressure.

This often happens in an inflammatory process, due to gravity or some other cause. The outflow of blood in the veins and of the lymph in lymph spaces and lymphatics is interrupted, causing congestion and interference with the free circulation of fresh blood in the part.

Position is an important factor in such cases. By certain positions the rate of the flow of blood in the congested part may be stimulated so that waste and toxic substances will be removed and nourishing and vitalizing elements will be brought to take their place.

Examples of Position as a Factor in Treatment.—In pneumonia, in which the lungs are congested and the circulation is poor, a patient is not allowed to lie on his back or in one position long, but is frequently turned from side to side, if possible, to prevent congestion by gravity in any part of the lungs. For the same reason, the position of a patient following an operation is changed from time to time. With an inflammatory process in an extremity, the part is elevated and supported to aid the return flow of blood by gravity and prevent congestion. Following an operation on the eye, to avoid congestion and the danger of a hemorrhage, the patient must lie flat on his back and never on the affected side. In all post-operative conditions the position is such as to prevent congestion or a strain on sutures or muscles and, if there is drainage, such as to localize the exudate and allow free drainage.

Pressure by bandaging, firm enough to control the outflow of blood in the veins without interfering with incoming arterial blood, is also an important factor in regulating an inflammatory process.

The following treatments are all local applications applied either for a local or reflex effect. They are used in both medical and surgical diseases, for inflammation is the lesion present in both types; this classification of diseases is based on the treatment, surgical or medical, and not on the lesion or disease. The following treatments, while basic, are, perhaps, more medical in aspect as compared with pre-operative and post-operative treatments which are distinctly surgical.

The Effects the Applications are Intended to Produce:

1. To relieve inflammation and congestion.

2. To relieve pain due to irritated sensitive nerves.—Pain is a symptom which demands immediate relief. It is Nature's way of reporting an injury and insisting that the part will not be used until the condition or injury is relieved. Pain may be due to pressure on the nerves, or to direct injury to the nerves. It may be relieved by applications which remove the pressure, soothe the nerve endings, or actually deaden the sensation of pain.

3. To relax muscles, tendons, ligaments and fascia.—Sometimes, ligaments and tendons become stiff, fatigued, cramped, and painfully contracted from strain, overwork, exposure to cold, or from the accumulation of waste products, toxins from bacteria, and other poisonous substances. They are then not only painful but are unable to function properly. For instance, a cramped heart muscle can no more pump the blood into the arteries properly than we can write freely or legibly with stiff, cramped, and painful fingers. Applications may be made to relax these tissues, relieve pain, and restore their function.

4. To cause the contraction of muscles.—Muscles of the internal organs, such as the heart, blood vessels, intestines and bladder, may lose their tone so that they become relaxed, unable to contract and to function properly. For instance, the relaxed intestines allow the accumulation of gas and fecal matter within them. This causes discomfort and pain and interferes not only with digestion but with the action of vital organs, the heart and lungs. The relaxed walls of the bladder cause retention of urine;

the relaxed heart muscle beats very feebly so that the circulation of the whole body suffers. Applications may be made to stimulate and restore the tone and function of these muscles.

LOCAL APPLICATIONS OF HEAT

1. Applications of *Dry Heat.*

(*a*) A hot-water bag, an electric pad, hot air or baking, and the thermo-cautery (See Chapter XXI).

(*b*) Applications of Radiant Light and Heat.

(*c*) Medical and Surgical Diathermy.

2. Applications of *Moist Heat.*

(*a*) A hot foot bath, a Sitz bath, a flaxseed poultice, compresses and fomentations.

The Physiological Action of Heat.—The effects produced in the application of heat to the body depend upon (1) the mode of application, that is, whether in the form of hot air, hot water, vapor, or electric light, etc.; (2) the temperature; (3) the duration, whether short or prolonged; (4) the surface of the body exposed and whether the application is local or general; (5) the condition of the patient.

The hot-water bag and baking are local applications applied chiefly for their local effect.

The Local Effect of Heat on the Tissues:

Water 104° to 130° F., or air 120° to 250° F.

1. *On the Skin and Mucous Membranes.*—A very high temperature (120° to 160° F.), which is hot enough to cause pain, will contract the numerous small involuntary muscles in the skin and small blood vessels and squeeze the blood out of the capillaries and arterioles so that the part becomes pale, and bleeding, if present, is checked. At a more moderate degree of heat, however, the involuntary muscles and elastic tissue in the skin become relaxed so that pressure normally exerted on the capillaries and small blood vessels in the skin is removed and the vessels become relaxed. There is, therefore, more blood in the vessels of the skin so that there must be less blood in the blood vessels in the adjoining tissues under the skin supplied by the same blood vessels. In this way blood may be drawn away from an inflamed, congested area beneath the skin, as in an infected finger or boil, so that pain is relieved by withdrawing pressure from sensitive nerve endings. The *secretions* of the skin are also increased so that it becomes *moist* and *red*. *Prolonged applications* soften and weaken the skin and lower its resistance. The veins, because they are more superficial and because their walls are thinner and less muscular than the arteries, become more dilated so that there is more venous blood in the part and the skin becomes dusky, instead of a bright red hue.

2. *On the White Fibrous Tissue.*—Tendons, ligaments, fascia, etc.—Heat softens, expands and relaxes, and so relieves pain and stiffness, and restores the function. This expansion of the

body tissues by heat explains why a ring, shoe, or glove feels tighter when the hands or feet are hot as in summer.

3. *On the Muscles.*—Heat which can be tolerated in a foot-bath or a full bath (104° to 110° F.) relaxes the muscles and so relieves cramped, fatigued, painful muscles. A very high temperature applied locally for a brief period, for instance, a square of blanket wrung out of boiling water as in a fomentation will stimulate the contraction of involuntary muscles such as in the intestine, and so relieve pain due to gas.

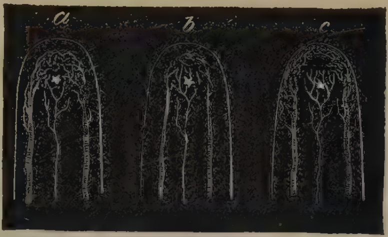

Fig. 26.—Diagram Showing the Effect of Heat and Cold in Lessening the Pain of Inflammation in the End of a Finger. The small star indicates the point of irritation, e.g., a prick of a thorn. The line in the center of each figure is intended to represent the nerve going to the injured part; and at the side of each figure is an artery and vein connected by a capillary network. In *a* the capillary network around the seat of irritation is seen to be much congested; the nerve filaments are thus pressed upon, and pain is occasioned. *b* represents the condition of the finger after the application of cold to the arm or hand. In consequence of the contraction of the afferent arteries the finger becomes anemic; no pressure is exerted on the nervous filaments, and pain is alleviated. *c* represents the finger after it has been encased in a warm poultice; the capillary network at the surface of the finger is dilated, and the blood is thus drawn away from the seat of irritation, and the pain therefore relieved. (From Brunton's "Lectures on the Action of Medicines," Macmillan Co., Publishers.)

4. *On Bacteria.*—Moderate heat favors the growth of bacteria.

5. *On the Blood.*—Heat increases the number of leucocytes in the part. It therefore promotes suppuration, aids and stimulates the absorption of inflammatory products (resolution), and relieves swelling and pain.

6. *On Nutrition.*—Heat is a vital stimulant. It stimulates all the activities of protoplasm and the cells, and so stimulates the formation of new tissue and growth. Note the effect of the sun on plants and fruit, and its effect on the skin in stimulating the pigment-forming cells with the production of freckles.

Local Applications of Heat are, therefore, Contra-indicated and must not be used to relieve pain (1) when it is desirable to check suppuration as in appendicitis when the formation of an abscess would greatly increase the danger, and also in other cases (as in the beginning of a stye, or boil, or abscess in tooth or ear) when the object is to check abscess formation; (2) when infection is present as in a carbuncle (a honeycomb of boils) and the softening of the tissue caused by the heat would allow the infection to spread or burrow deeper into the surrounding tissues.

Reflex Effect of a Local Application of Heat.—It has been found by experience and by very careful studies and experiments that each internal organ (or the blood vessels supplying it) is reflexly related to some portion of the skin or body wall; that is, the nerves supplying these internal organs are very intimately associated through centers in the brain and spinal cord with the

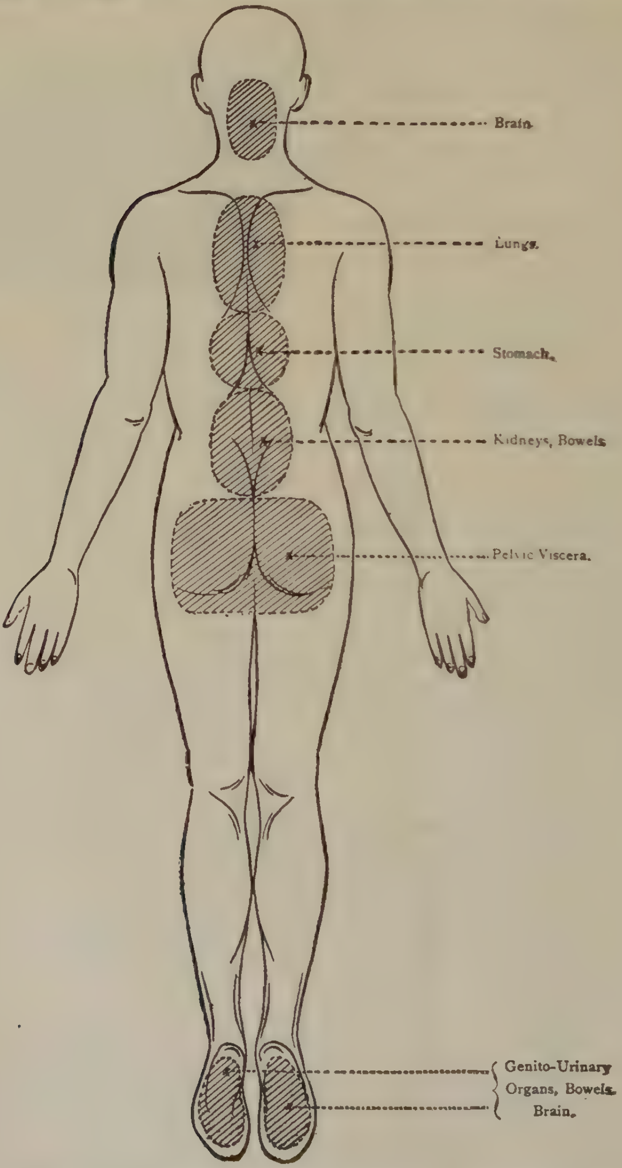
Brain.
Lungs.
Stomach.
Kidneys, Bowels.
Pelvic Viscera.
Genito-Urinary Organs, Bowels.
Brain.

Fig. 27.—Cutaneous Areas Reflexly Associated with Internal Parts. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

sensory nerves in definite portions of the skin. For instance, as shown in Figures 27 and 28, the brain is related with the skin of the face, scalp, back of the neck, and also with the feet; the stomach is reflexly related with the skin over the epigastrium; the lungs are reflexly related with the skin over the chest; the

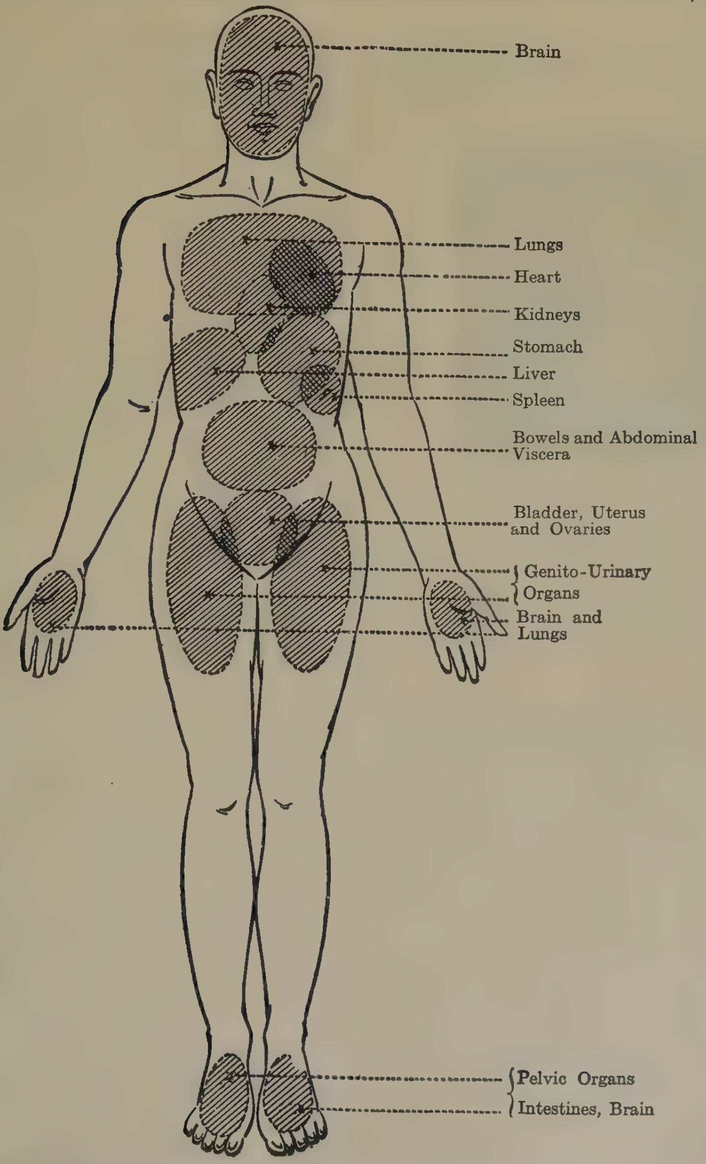
Brain
Lungs
Heart
Kidneys
Stomach
Liver
Spleen
Bowels and Abdominal Viscera
Bladder, Uterus and Ovaries
Genito-Urinary Organs
Brain and Lungs
Pelvic Organs
Intestines, Brain

FIG. 28.—CUTANEOUS AREAS REFLEXLY ASSOCIATED WITH INTERNAL PARTS. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

intestines are reflexly related with the skin and body wall of the abdomen; the internal organs of the pelvis—uterus, bladder, colon and rectum—are reflexly associated with the wall of the lower abdomen or pelvis; the brain, lungs and upper respiratory tract, and the pelvic organs are reflexly associated with the feet.

Through this intimate nerve connection, applications to the skin—whether of heat, cold, friction, mustard, or other irritant—which stimulate the nerve endings in it, will produce changes in the circulation of the internal organ reflexly associated with the skin area to which the application is made. The result is relief of congestion and the symptoms of distress due to it, such as pain, dyspnea, and cyanosis in congestion of the lungs in pneumonia; or pain and suppression of urine in inflammation and congestion of the kidney as in nephritis. By such applications, also, the involuntary muscles of internal organs such as the intestines or the heart may be stimulated and made to contract so that distention of the intestines may be relieved, and the heart-beat may be made stronger and faster.

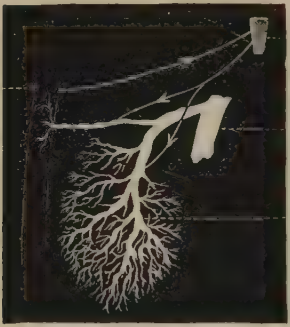

Fig. 29.—Diagram to Show Congestion of the Lung. The pulmonary vessels are shown dilated and those of the thoracic wall contracted. (From Brunton's "Lectures on the Action of Medicines," Macmillan Co., Publishers.)

That such relief is produced is a matter of common experience, a well-known fact, accepted by all authorities. Authorities, however, differ widely as to the way in which applications of heat or of such irritants as mustard, etc., bring about these beneficial results. Some believe that, through irritation of nerve endings in the skin, nerve centers in the brain are stimulated and that these cause the blood vessels in the skin to dilate, thus drawing more blood to them, and cause the blood vessels in the internal organ reflexly related with that skin area to contract, thus driving blood away and relieving congestion as shown in figures 29 and 30. Others believe that, for instance, a hot application to the chest which makes it red, showing that the circulation is stimulated and flowing more freely, will have the same effect on the lungs; that is, the outflow of venous blood or waste products is stimulated and, also, the inflow of fresh arterial blood, thus nourishing and reviving the tissues and increasing their resistance.

As there is just a certain volume of blood in the body, it will easily be seen that, if a hot application draws a large volume of blood to one part of the body (as it does to the feet and legs in a hot foot-bath) it must necessarily reduce the blood supply in other parts of the body.

Again it must be remembered that when heat is applied to cause contraction of involuntary muscles, as in the application of stupes to relieve distention by causing the contraction of the muscular wall of the intestines, the application must be very hot and the high temperature must be continuous throughout the treatment which usually lasts from 10 to 20 minutes. (See local effect of heat.)

The Effect of Moist Heat.—Moist heat is much more penetrating than dry heat because water has a power of absorbing and communicating heat greater than that of air. Water is a much better conductor of heat, and, therefore, moist heat makes a much more intense impression upon the skin than dry heat. Applications of moist heat also prevent loss of heat either by radiation or evaporation (if kept covered) and this further intensifies the effect.

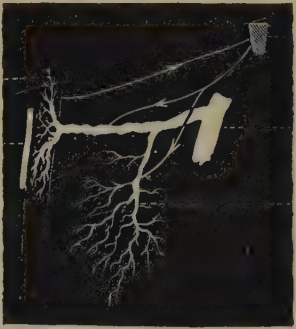

Fig. 30.—Diagram to Explain the Action of Counter-Irritation. A blister or other counter-irritant is shown applied to the chest wall. The stimulus which it causes is transmitted up the afferent nerves to the vaso-motor centre; it is thence reflected down the vaso-motor nerves to the pulmonary vessels causing them to contract, while it is reflected down vaso-dilating fibres to the vessels of the thoracic wall and probably of other parts of the body also, causing them to dilate and thus lessening the pulmonary congestion by withdrawing blood from the lungs. (Compare with Fig. 29.)

Local Applications of Dry Heat.

A Hot-water Bag

A hot-water bag may be used as a therapeutic measure in a variety of conditions among which are the following: (1) to relieve pain in toothache or earache by drawing blood to the face and so relieving congestion in the vessels supplying the tooth or ear; (2) applied to the abdomen to relieve pain due to congestion of the pelvic organs—the uterus, ovaries or bladder—and in dysmenorrhea; (3) applied over the bladder or to the perineum to overcome retention of urine; (4) applied to the abdomen to relieve intestinal or renal colic; (5) to relieve pain in neuralgia and sciatica, etc.

Method of Application.—The temperature of the water must always be tested with a thermometer. It may vary from 120° F. to 150° F., depending upon the thickness of the cover used, the area to which the application is made, and the condition of the patient and the skin. It must never be hot enough to burn the patient should the bag leak or the rubber burst. To avoid such serious and inexcusable accidents, before use the bag must be carefully examined for leakage and for weak places in the rubber. The bag must always be completely covered with a suitable cover and the patient should be warned and watched to prevent him from removing it if he is likely to do so in the desire to relieve intense pain.

The avoidance of unnecessary weight is extremely important.

If the patient must support the weight of the bag, as when applied to the abdomen, it must not be filled more than one-third full and all the air must be carefully expelled from it. Even this light weight may be unbearable and may have to be supported by suspending it from a cradle or by some other means of relieving the weight.

If the application is to be continued, see that the bag is regularly refilled and kept hot. Watch the position of the bag. The patient may be restless (particularly if in pain), displace the bag, roll over on it, and become badly burned.

Do not leave the bag with the patient longer than the application demands. See that it is dried and put away in the proper place and in the proper manner.

LOCAL HOT-AIR BATH

The treatment consists in the application of superheated air to the affected part, such as an arm, leg, or knee-joint. It is called "baking" the part.

Baking is used as a therapeutic measure in (1) inflammatory joints due to rheumatism; (2) inflammatory muscles; (3) chronic inflammation of joints with an exudate; (4) gonorrheal arthritis; (5) gout.

Baking is contra-indicated in acute rheumatic fever or in any febrile condition, in acute inflammatory conditions, and in cases in which the skin of the part is broken or diseased.

Effects of Baking.—The local application of hot air usually brings great relief and comfort to the suffering patient. It increases the temperature of the part because the hot air surrounding it prevents the loss of heat. All the activities of the cells or protoplasm are stimulated. Heat accumulates in the part and the temperature of the blood throughout the body may be raised. The surface blood vessels dilate; the skin becomes red; an increasing volume of blood flows through the surface vessels, thereby mechanically withdrawing blood from the adjoining tissues or joints and thus relieving congestion. The affected part and the whole body perspire profusely because the increased temperature of the blood and the stimulation of the nerve endings in the skin by the heat, together cause a stimulation of the sweat centers and heat regulating centers in the brain. These immediately set about preventing a further increase of body temperature by producing a profuse perspiration with an increased elimination of waste products. This increased volume of healing blood and leucocytes in the part aid in combating the infection and in stimulating the absorption of inflammatory products. The tendons, ligaments and fascia are softened and expanded; the muscles are relaxed; pain is relieved, stiffness is removed, and the function of the part is restored.

The Apparatus.—There are several forms of apparatus on the market, so that the method of baking the part will depend upon the form of apparatus used and also upon the part of the body to be baked. These chambers are metal boxes lined with asbestos and containing an asbestos board or rest for the arm or limb. A thermometer is suspended in the chamber.

The *temperature* of the air varies from 200° F. to 300° F.

The *duration* of the treatment varies. It may be resorted to daily or several times a week and each treatment may last from a few minutes to several hours (usually one hour) depending upon the temperature used, the sensations of the patient and the nature of the case under treatment.

Method of Procedure.—First see that the room is warm and that the patient is protected from chilling before, during, and after the treatment. The patient must be undressed (having on a gown, wrapper, stockings and slippers) for the treatment, as it causes general profuse perspiration. Several blankets should be used to protect him from getting cold. His position and the position of the part being baked should be made comfortable and all straining of muscles from a cramped position avoided. Cold applications should be applied to the head before, and during, the treatment.

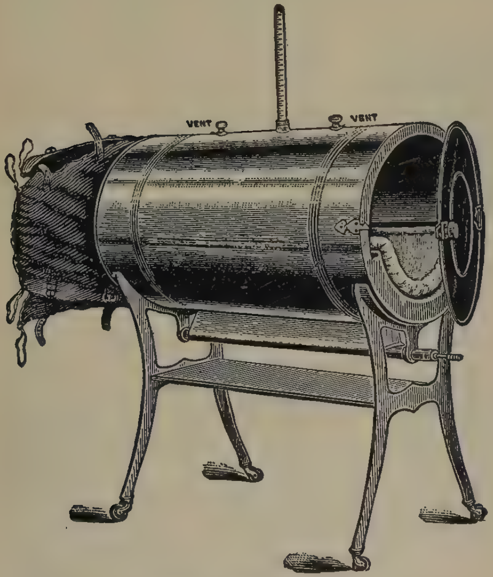

Fig. 31.—Frazier-Lentz Hot-Air Apparatus. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

The asbestos board or rest (which becomes very hot) should be covered by a pad of linen. The arm or limb must be protected by a properly fitting flannel covering and not allowed to come in contact with either the asbestos or metal. No rings should be worn by the patient and no pins used in the protector as all metals are good conductors of heat and would burn the patient. The asbestos covering which guards the opening and a blanket should be snugly drawn around the limb. The temperature of the bath must be raised gradually. Both the temperature and the duration of the treatment may be increased from day to day as the patient becomes adjusted to it. The patient should never be left alone and should be watched closely for signs of weakness. He should be encouraged to drink fluids before and during the bath in order to encourage the elimination of waste products and to prevent the body tissues from suffering owing to the loss of so much water.

At the end of the bath the limb should be well wrapped up with wool, covered with rubber cloth, and flannel, to continue the effect of the bath. Some doctors advise that the whole body have a short cold application such as a cold towel rub, followed by careful drying and thorough rubbing. If the affected part will bear rubbing, some doctors also advise a very brief (four to thirty seconds) dry cold application (wring towel very dry before applying) followed by drying and vigorous rubbing. This acts as a tonic to the passively dilated blood vessels, and prolongs the effects of the bath. In some cases the patient is put to bed between blankets, dried and given an alcohol rub. Because of the free perspiration and weakening effect of the treatment the patient should always rest in bed following it.

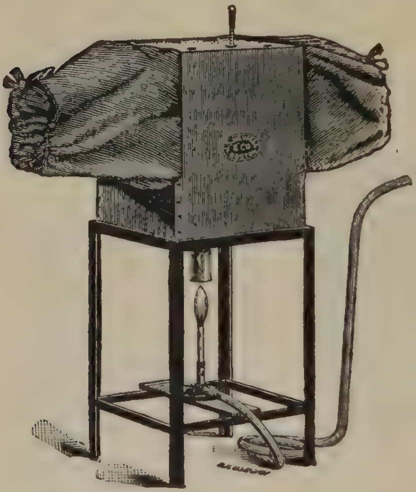

FIG. 32.—THE NEWELL HOT-AIR APPARATUS. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

APPLICATIONS OF RADIANT LIGHT AND HEAT

Radiant light consists in the luminous and heat rays from the sun, electric arc-light, or the incandescent light. For therapeutic purposes the incandescent light, in the form of lamps (varying from 100 to 2000 candle power) with reflectors, is usually used. As the lamps are enclosed in glass bulbs there are no ultra violet rays. When the light rays pass through blue glass the effect is somewhat less irritating and slightly analgesic.

The Action of Radiant Light and Heat.—It is an application of dry heat and some authorities say that the effect is the same as from other forms of heat, but that it is a more convenient form of application. Others say that while other applications of heat, conveyed by actual contact with a heated body or with heated air, affect only superficial tissues (the heat being absorbed and diffused by the circulating blood and hence not affecting deeper tissues), the radiant light rays not only heat the air but actually *penetrate* human tissues from 1⅛ to 1¼ inches. (Authorities differ as to the degree of penetration.) Owing to the resistance offered by the tissues, the radiant energy is *converted into heat in the tissues* and so reaches deeper tissues, sinuses, glands, smaller joints, the middle ear, and some mastoid cells.

Uses of Radiant Heat.—It is used for the same purposes as other applications of heat, particularly to relax tissues before manipulation or massage, to relieve painful joints, pain in the middle ear, for infected sinuses and other local infections.

The Method of Application.—Special lamps may be used, or a light suspended from a cradle is frequently used as a substitute. The light is adjusted from 12 to 18 inches from the skin and directed on the area to be treated. The area must be watched closely, and all the usual precautions against burning, etc., must be emphasized because of the penetrating and more intensive heat of the application. For the incandescent light bath see Chapter XXIII.

MEDICAL AND SURGICAL DIATHERMY

Diathermy is a therapeutic electrical treatment which consists in passing a high-frequency current from one electrode to another through human tissues. Owing to the resistance offered by the tissues to the current, the electric energy is converted into heat in the tissues through which the current passes.

Medical diathermy is a means of applying heat to deep-seated tissues not obtainable in any other way. The degree of heat can be regulated and localized in any area. It has all the beneficial effects of heat and helps greatly in the more rapid restoration of function. It is used in the early treatment of fractures and joint injuries to lessen spasm, pain and swelling, and to thus aid in their proper manipulation, reduction and treatment. It is also used in post-operative bone and joint conditions before manipulation or massage and for its general stimulating effects.

Surgical diathermy is used for the destruction or removal of lesions such as warts, moles, and papillomas by creating sufficient heat to cause either desiccation of the tissues or actual destruction.

Method of Application.—These treatments will be applied by a surgeon or a physiotherapist but they are frequently used and it is important that student nurses understand the treatments which their patients are receiving.

LOCAL APPLICATIONS OF MOIST HEAT

THE FOMENTATION OR STUPE

The fomentation is a clean, efficient, and economical method of applying moist heat by means of two or more thicknesses of flannel cloth or old blanket wrung as dry as possible out of boiling water and applied directly to the skin a number of times in succession. The heat and moisture are retained by covering the application with a piece of dry flannel and rubber tissue or oiled muslin. It is essentially a local vapor bath.

For the *effects of the fomentation* see the effect of a local application of moist heat. Very hot applications, such as the fomentation, also lessen the sensibility of the nerve endings in the skin and thus relieve pain. By their sedative effect on the nerve endings in the skin, they also relieve pain in deep-seated, painful parts, if applied to a region of the skin associated reflexly with them through the nervous system.

Fomentations are Used as a Therapeutic Measure:

1. To relieve pain and congestion in the adjoining parts by their analgesic or pain-relieving effect on the nerve endings, and by mechanically drawing blood from the congested parts to the skin. They are used for this purpose in strains or sprains of joints or muscles (if the skin is unbroken); in dislocations and fractures to relax the tendons, relieve pain and prevent swelling; in lumbago and sciatica; in rheumatic joints and muscles; in the very early stages of a boil in order to bring the healthy blood to the part and stimulate its vital resistance, and in the later stages of a boil to promote suppuration,—caution must be observed because the heat softens and lowers the resistance of the tissues, so may cause the infection to spread and burrow deeper; in toothache and earache to dilate the vessels in the skin and relieve congestion, pressure and pain in the tooth or ear; in mastitis (with caked milk) in order to soften and expand the tissues so that the milk may be expressed; in tonsillitis and laryngitis or croup.

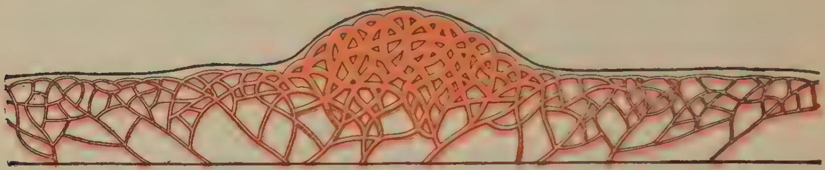

Fig. 33.—Diagram Showing Local Cutaneous Congestion, as in a Boil. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

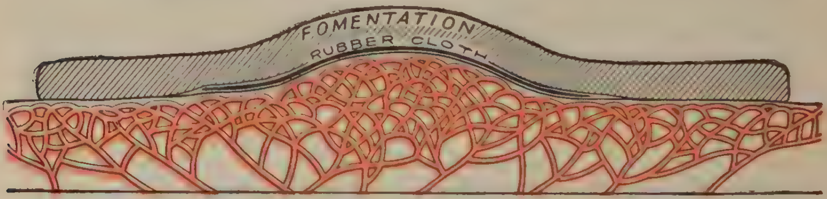

Fig. 34.—Diagram Showing Relief of Local Congestion by a Fomentation Which Dilates the Surrounding Vessels. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

2. To relieve pain and congestion in internal organs by their analgesic effect on nerve endings, by reflex action, and by drawing blood to the skin in the following conditions: In inflamma-

tion and congestion of the kidneys with suppression of urine; in all pelvic congestions of the uterus, ovaries or bladder, and in dysmenorrhea; in acute gastritis and intestinal catarrh; in pneumonia, pleurisy and acute bronchitis.

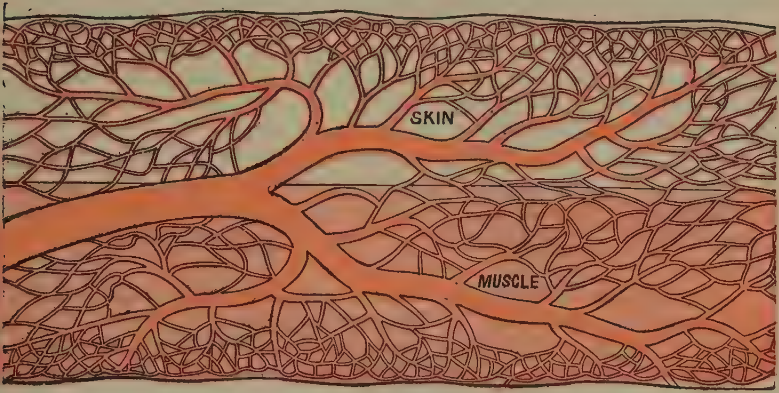

Fig. 35.—Diagram Showing Collaterally Related Vascular Areas, Skin Overlying Muscle. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

3. To relieve distention or tympanites in pneumonia, typhoid, peritonitis and post-operative cases by causing the contraction of the smooth muscles of the intestines and the expulsion of the gas.

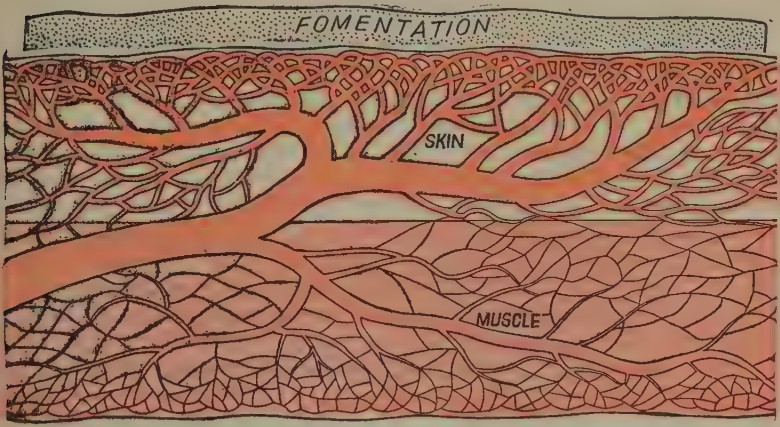

Fig. 36.—Hyperemia of Skin with Collateral Anemia of Underlying Muscle Produced by a Hot Application. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

4. To relieve intestinal and renal colic.
5. To reduce a swelling; to stimulate the absorption of effu-

sions or exudates; to increase the local blood supply, promote leucocytosis and functional activity.

6. To accumulate heat and raise the temperature of the part. —It is now thought that the increased body temperature which occurs in infectious diseases is one of Nature's methods of defense against the invading enemy, a means of making the tissues an undesirable abode for those parasites "who unbidden eat at the table of another at his expense." In the same way it is thought that increasing the temperature of a locally inflamed part aids the issues in their natural processes of defense.

Fomentations are usually most effectual in the above conditions and give the patient prompt and great relief.

Method of Procedure.—The essential factors to be considered in making the application in order to obtain the desired results are:

1. *The Preparation of the Patient.*—It is important to see that the patient is protected from exposure and chilling—an extra blanket for the chest, etc., should be used when necessary. Chilling of the body surface causes congestion of internal organs and the purpose of the treatment may be to relieve this. The extremities, particularly, must be warm. Some doctors advise that during the treatment cold applications should be made to the head, particularly if there is any tendency to congestion of blood in the head. The bed linen should be arranged conveniently, avoiding exposure. It should be protected so as to avoid the possibility of it being dampened by the moist applications. This would chill the patient afterwards.

2. *The Area to be Covered.*—This depends upon the object: When the object is to cause an increased volume of blood in the skin and relieve congestion in the adjoining parts or internal organs, the fomentations must be *very large* so as to withdraw a large volume of blood. For instance, applications to *relieve congestion in the kidneys* must cover the whole central and lower part of the back and come well around to the sides; to *relieve inflammation of joints,* the application should be closely wrapped completely around the joint and extend several inches above and below it; *to relieve pain in the stomach,* the application must extend from the fourth rib to the umbilicus and between the two axillary lines; *to relieve pain or congestion in pelvic organs,* the application must extend over the whole lower abdomen and well over the hips and thighs; *to relieve pain, in abdominal organs,* the application must extend from above the waistline and well down over the hips; *to relieve inflammation or congestion of the breasts,* the application should be applied closely around the breasts but the nipple must never be covered.

When applied for a purely local effect as in the relief of an infected finger or boil, etc., the application *should not be larger than necessary,* in order to avoid dilating the artery supplying the part and thus increasing the congestion. For instance, when the object is to relieve inflammation of the eyeball the application should cover the eye and extend over the brow (but not over the cheek) in order to dilate the artery supplying the eyelids and forehead (the supra-orbital branch of the ophthalmic artery) and withdraw blood from the vessels of the eyeball; when applied to relieve toothache or earache, the application should be made to the face only (to draw the blood to the surface vessels) but should never extend below the jaw as this would dilate the carotid artery and its branches supplying the face and head and thus increase the congestion and pain.

3. The *solution* most commonly used is plain boiling water. Turpentine is frequently added to abdominal stupes as an added irritant for the relief of distention, etc. It is *never used* for fomentations applied for the relief of pain or congestion of the kidneys and suppression because the turpentine if absorbed would have to be eliminated by the kidneys, and as it is very irritating, would aggravate the already inflamed condition.

4. The *applications* are made by immersing soft pieces of flannel (the required size) in the boiling water until thoroughly saturated, then wringing them as dry as possible and applying directly to the skin.

When *turpentine stupes* are ordered, the turpentine may be added to the boiling water in the proportion of 3 teaspoonfuls of turpentine to 3 pints of boiling water. The water is allowed to boil freely again before immersing the flannel. Another method of applying turpentine stupes is to thoroughly mix one part of turpentine to two or three parts of olive oil for adults, and one to six or ten for children. Apply this before every second or third fomentation or as often as the skin will allow.

5. The *temperature* of the applications will vary from 140° to 160° F. They are applied as hot as the patient can stand, that is, hot enough to cause pain when first applied.

6. *The Care of the Skin and Protection of the Part.*—The greatest care must be taken to prevent the skin from being burned. Wring the flannel as dry as possible. Apply it gradually and, if it causes too much pain, lift it up for a second and then replace it so that the skin may become gradually used to the extreme temperature. Oil the skin if tender, or if applications are made frequently. This prevents burning or softening of the skin. Take special care in distention, when the skin is apt to be stretched, also when the part is paralyzed, insensitive or benumbed by cold—it is safer to apply the fomentations at a lower temperature or to use plenty of vaseline.

Avoid chilling the part before, during or after the treatment. It is first covered with a soft, dry, warm piece of flannel, large enough to extend well beyond the area on all sides. All applications are made beneath this flannel. Avoid currents of air or exposure during the applications, as this will cause loss of heat and chilling. Avoid any evaporation of heat or cooling of the part by using two hot fomentations in succession, applying one quickly as the other is removed.

7. The *duration and frequency* of the treatment vary with the condition. The desired temperature may be maintained by changing the compress every two or three minutes during a period of from ten to twenty minutes. The applications are renewed every two, three, or four hours as the case may demand. In some cases one application is left on for fifteen to twenty minutes, then removed, a fresh application being made once each hour. The treatments will probably be continued as long as they give relief to the pain or other symptoms present.

8. After the removal of the last hot compress, dry the part and leave it covered with the soft, dry, warm flannel to prevent chilling, but do not have it sufficiently warm to cause perspiration. Oil the skin if very red or tender.

9. When fomentations are applied to the abdomen for the relief of distention, an order is usually given to insert a rectal tube into the rectum before beginning the treatment and to allow it to remain during and for some time after. The free end of the tube must be in a receptacle in the bed because fecal matter is frequently expelled with the gas.

Chart the treatment as given and its effect on the patient.

A Poultice or Cataplasm

The poultice is an application of moist heat in the form of a soft paste which retains its heat for a varying length of time according to the ingredient used. The good effects of the poultice depend mainly upon the heat.

The *ingredients* commonly used are flaxseed or linseed, bread, hops and digitalis. Flaxseed is the best because of its mucilaginous and oily ingredients. It is more soothing to the skin, may be used at a higher temperature without burning, retains its heat longest, and air can be readily incorporated in it, making it light and more bearable to the patient.

The *effects* of the poultice are the same as those due to the fomentation and, like the fomentation, usually give the patient great relief and a sensation of comfort if properly applied. If not properly applied it causes discomfort and may do harm.

Poultices are used for purposes similar to the fomentations, but are most commonly used as a therapeutic measure in the following conditions: (1) Pneumonia, to stimulate the absorption of the products of inflammation and congestion, and to relieve pain, dyspnea and cyanosis. (2) Pneumonia and post-operative cases to relieve distention. (3) Over painful, inflamed and infected wounds, and suppurating areas.

The Method of Procedure.—The important factors to consider in making and applying a flaxseed poultice in order to obtain the best results are:

1. The *temperature* of the poultice should be as hot as the patient can stand. It is tested with the back of the hand or by holding it to your cheek.

2. The *size* of the poultice should be large enough to com-

pletely cover the desired area. For instance, in pneumonia, the application may be required to cover the whole anterior or posterior chest, or merely the chest covering the base of the lungs, anterior or posterior. Sometimes, particularly for children, the poultice is made to cover the whole of one or both lungs. The application is called a jacket poultice. As the apex of each lung extends above the clavicle and its lower border extends obliquely downward from the sixth costal cartilage in front to the seventh rib at the side and the eleventh rib at the back, an application to both lungs must extend from the neck to the base of the lungs, completely enveloping the sides, shoulders, anterior and posterior chest. When the application is made to one lung, the patient should lie on the unaffected side and the application should extend from the neck to the base of the lungs and from beyond the midline in front to beyond the midline in the back. The poultice, flannel cover, and binder used to hold it in place, should each be shaped so as to fit under the arms and at the neck.

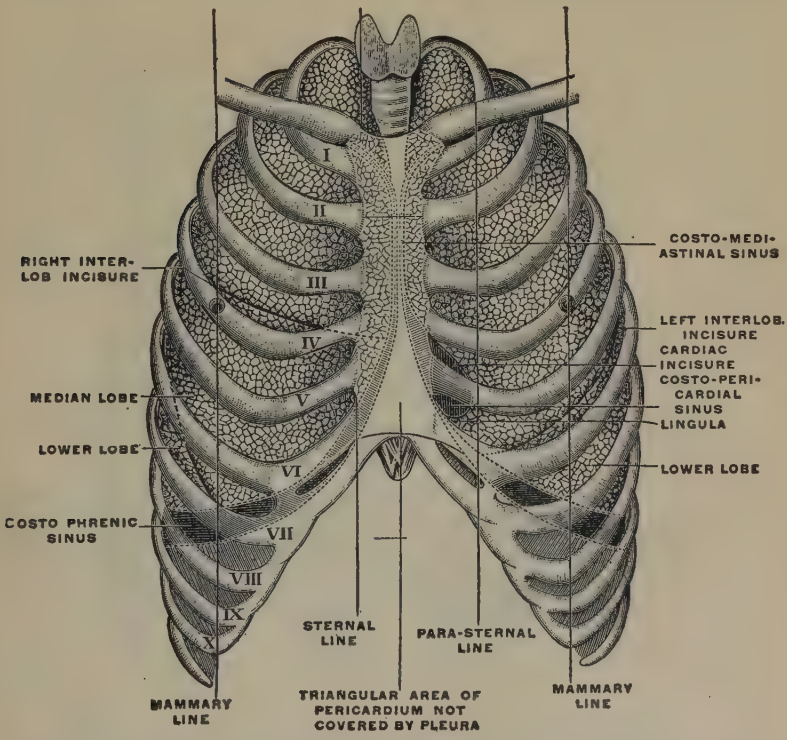
I
II
III
IV
V
VI
VII
VIII
IX
X
RIGHT INTERLOB INCISURE
MEDIAN LOBE
LOWER LOBE
COSTO PHRENIC SINUS
MAMMARY LINE
STERNAL LINE
TRIANGULAR AREA OF PERICARDIUM NOT COVERED BY PLEURA
PARA-STERNAL LINE
MAMMARY LINE
COSTO-MEDIASTINAL SINUS
LEFT INTERLOB. INCISURE
CARDIAC INCISURE
COSTO-PERICARDIAL SINUS
LINGULA
LOWER LOBE

Fig. 37.—Position of Lungs and Pleura with Reference to the Anterior Chest Wall (copied from Joessel). (From Woolsey's "Applied Surgical Anatomy," Lea and Febiger, Publishers.)

3. The poultice should be light, thick enough to retain the

heat, of the right consistency, perfectly smooth and even, hot but not too hot.

4. To insure the proper temperature, weight and consistency, before beginning to make the poultice see that everything necessary is at hand so that there will be no unnecessary delay in applying it. The utensil used for mixing should be hot; the water should be boiling; the flaxseed is added to the boiling water gradually, at the same time stirring constantly with a spatula. The water must not stop boiling. When the mixture will drop clean from the spatula, it is of the right consistency. Beat the mixture thoroughly so as to introduce air and make it as light as possible. It is then spread evenly on old muslin and covered with gauze or muslin, in each case leaving sufficient margin to turn in neatly so that there can be no possible escape of the flaxseed. It is then wrapped in a warm towel or in a piece of warm flannel or old soft blanket and taken to the bedside. This flannel may be left on the part after the poultice is removed, to prevent chilling.

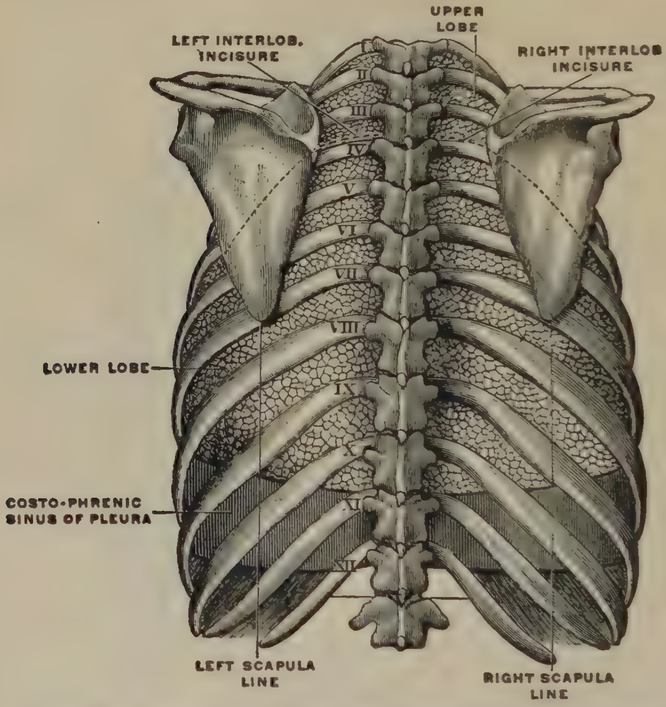
UPPER LOBE
LEFT INTERLOB. INCISURE
RIGHT INTERLOB INCISURE
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
LOWER LOBE
COSTO-PHRENIC SINUS OF PLEURA
LEFT SCAPULA LINE
RIGHT SCAPULA LINE

FIG. 38.—POSITION OF LUNGS AND PLEURA WITH REFERENCE TO THE POSTERIOR CHEST WALL (copied from Joessel). (From Woolsey's "Applied Surgical Anatomy," Lea and Febiger, Publishers.)

Unnecessary weight is particularly to be avoided when a poultice is to be applied to the chest when breathing is already an effort as in pneumonia. The flaxseed should not be more than a quarter of an inch thick. Also, when applied to the abdomen for distention or to other tender areas, the poultice should be as light as possible. To other areas such as the extremities where lack of weight is not such an important factor, the poultice may be half an inch thick or more.

5. The *care of the skin* and protection of the part is much the same as in the application of fomentations. Avoid burning the skin. Oil the skin if the applications are frequent, or if the skin is likely to be tender; apply the poultice gradually; keep raising part of it until the patient is accustomed to the heat. In applying a poultice to the posterior chest, unusual care must be taken to prevent burning as (when the patient is lying on his back) there is no opportunity for radiation of heat so that the intensity of the application or the heat is greatly increased. Precaution against burning must also be observed in distention when the skin is apt to be thin, shiny, stretched, and tender. Avoid exposure of the part before, during, or after the treatment. Cover the poultice with flannel or oiled muslin, so as to retain the heat. Fasten it in place with a binder or bandage as the part may demand. This should not be neglected. A patient who is restless, suffering from distention, mental and physical distress, and difficulty in breathing as in pneumonia, or who is in severe pain should not be obliged to remain in one position or to worry about keeping a poultice in place. He should not bear the weight of it "on his mind" as well as on his chest or abdomen. Fasten binders only tightly enough to retain the poultice in place, not enough to restrict breathing, etc.

When applying a poultice over an abdominal dressing to relieve distention in post-operative cases, a single layer of gauze may be placed between the poultice and the dressing to protect the latter. The dressing itself must never be interfered with. Even when a thick abdominal dressing covers the wound, the poultice should not be hotter than usual. The heat penetrates the dressing and, particularly when the tissues are relaxed, may so soften the tissues around the sutures that they give way. The same care must be taken when applied over all wounds, sore and suppurating areas. As the heat softens and expands the tissues, in some cases this application is contra-indicated as it gives the infection a chance to burrow deeper.

6. The *duration* of the application in all cases should be only as long as the heat is retained (never longer than one hour) otherwise it not only causes discomfort but may produce an effect opposite to that desired.

7. After the removal of the poultice dry the part. Carefully inspect the skin. It should have a pink healthy glow showing the desired effect has been obtained. Oil it if tender or very red, and cover with soft flannel to prevent chilling.

When a poultice is applied to relieve distention in pneumonia or post-operative cases, a rectal tube is usually inserted into the rectum (by order) to aid in the expulsion of gas.

A MUSTARD POULTICE

Mustard is sometimes added to a flaxseed poultice to increase its irritating effect, thus adding a *chemical* irritant to the *physical* irritant, heat.

For the irritating properties of mustard see the *Mustard Plaster,* page 227.

The proportion of mustard to flaxseed should be ordered. For an adult it is usually one in eight, and for a child, about one in sixteen. To prepare, remove all lumps from the mustard flour. Then dissolve it in tepid water and add to the flaxseed mixture just before spreading on the muslin. First beat the mixture thoroughly to be sure the mustard is well mixed in it in order to avoid burning. Sometimes the flaxseed and mustard are mixed dry, then added to the hot water. As the mustard poultice is more irritating, the skin should be watched closely and the application removed when the skin is reddened. This usually occurs in from fifteen minutes to half an hour.

A HOT FOOT-BATH

The effects of this treatment depend upon the temperature and the duration of the bath and upon the fact that the feet (and lower extremities) are reflexly associated with the brain, lungs, uterus, ovaries, bladder and intestines. Any increase or decrease of the blood supply in the legs and feet will, therefore, have a marked influence upon the circulation in these organs:

A hot foot-bath momentarily causes an increase of blood in the head. At 98° to 106° F., if prolonged, it dilates the vessels of the feet and relieves congestion in the pelvic organs. At 103° to 110° F. it dilates the blood vessels of the feet and legs, thereby relieving congestion of the brain and the whole upper half of the body. At 115° to 122° F. it dilates not only the blood vessels of the feet and legs, but also those of the pelvic organs, therefore it is one of the best therapeutic measures in suppressed menstruation. At this temperature it also stimulates the involuntary muscles of both the pelvic and abdominal organs—the uterus, intestines, and bladder.

Purposes for which a Foot-bath is most Commonly Used: (1) To relieve congestion when the cause of headache, nervousness, and insomnia from overwork; (2) to relieve, prevent, or break up a cold or simple sore throat; (3) to induce menstruation delayed by an anemic condition of the uterus or ovaries; (4) to relieve pelvic congestion (prolonged at 98° to 106° F.); (5) to stimulate the bladder or intestines; (6) to relieve a sprain of the ankle, or gout; (7) to stimulate the paralyzed muscles in poliomyelitis (infantile paralysis).

The Procedure.—The *solution* used is usually plain hot water.

Sometimes mustard is added to increase the irritating or stimulating effect. It is used in the proportion of a tablespoonful of mustard to four quarts of *warm* water. Half this strength is used for infants. The mustard should first be well dissolved in a small amount of tepid water which should then be thoroughly mixed with the bath water. The mustard is sometimes first put in a muslin bag, then immersed in the tepid water and squeezed well in it. The water is then added to the bath. This is to avoid burning from particles of mustard which might not be thoroughly dissolved. (For the action of mustard see the Mustard Paste, page 227.)

The *temperature* of the bath should begin at 100° or 102° and should be gradually increased to as hot as it can be borne without causing faintness. When mustard is used the bath is usually given at 100° to 105° F., the "hotness" of the bath depending upon the irritating quality of the mustard and not on the heat of the water.

The Position, Preparation of the Patient and Method of Procedure.—The bath may be given with the patient reclining comfortably in a chair, or it may be necessary to give it in bed. When in a chair, the upper part of the body should be wrapped in a blanket, and a second blanket should cover the legs and enclose the bath. When in bed, the bedclothes are turned back; the bed is protected and a blanket covers the limbs and encloses the bath. In either case no exposure is necessary and every precaution should be taken to avoid chilling. Before immersing the feet apply cold to the head to prevent cerebral congestion with consequent discomfort and headache. The feet must be thoroughly immersed for the depth intensifies the effect. Place the bathtub so that the feet and legs may be in a comfortable position. Immerse the feet gradually so that the patient may become accustomed to the high temperature.

The *duration* of the bath varies from five to thirty minutes.

The *Removal and After-Care.*—In removing the limbs avoid exposure and chilling. If the bath is followed by a dash of cold water its beneficial effects will be intensified and prolonged. Dry the limbs and feet thoroughly and leave them wrapped in the blanket for from twenty to thirty minutes.

THE HOT SITZ BATH

In the Sitz bath the patient sits in the bath immersed from the waist to well below the thighs. The feet are in a second hot tub at 110° to 120° F.

Effect of the Bath.—The hot Sitz bath and the hot foot-bath are both applications of moist heat. The effects are the same as in other hot moist applications which have already been explained. Together they dilate the branches of the external iliac artery (a branch of the common iliac), and thus drain blood from the internal iliac and its branches which supply the pelvic viscera.

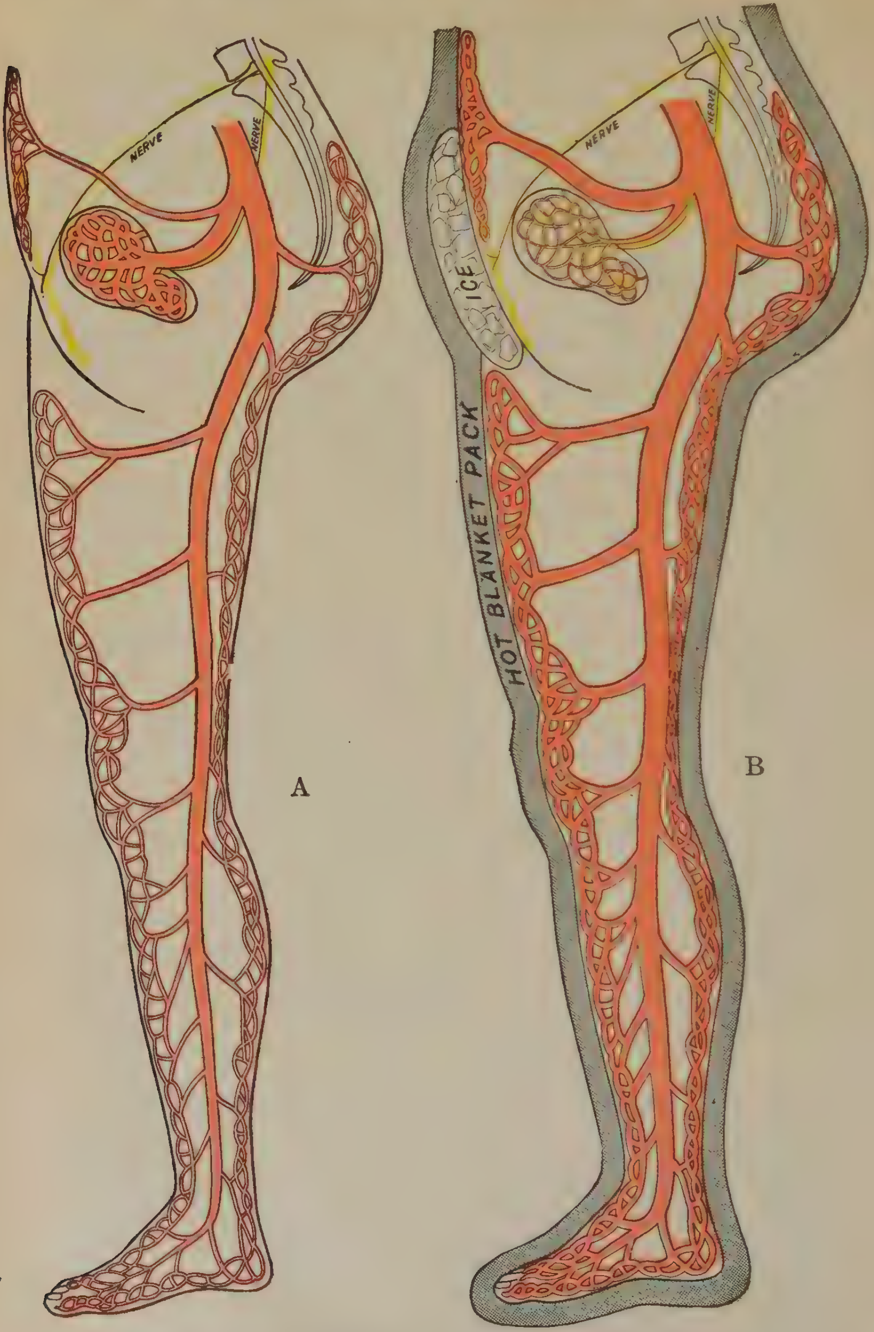
NERVE
NERVE
A
NERVE
NERVE
ICE
HOT BLANKET PACK
B

FIG. 39.—DIAGRAM SHOWING COÖPERATION OF REFLEX AND FLUXION EFFECTS IN PELVIC INFLAMMATION, UTERUS CONGESTED. A, BEFORE APPLICATION; B, DURING AND AFTER APPLICATIONS. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

The treatment is used for the following purposes:

1. To relieve pain and congestion in pelvic organs.
2. To restore the menstrual function.
3. To relieve painful hemorrhoids.
4. To relieve tenesmus, uterine and renal colic.
5. To relax the sphincter of the bladder, and overcome retention of urine.
6. To relieve sciatica.

The *solution* used is usually plain water.

The *temperature* begins at 100° F., and is increased from 106° to 120° F., or as hot as the patient can stand.

The Method of Procedure.—Before the patient is placed in the bath, cold applications are made to the head in order to prevent a rush of blood to the head with resulting congestion and headache. The baths are placed so that the patient can sit comfortably in one bath with the feet in the other. One blanket is draped around the shoulders and body while a second blanket covers the legs and feet, so that the patient and the baths are enclosed in the blankets.

The *duration* of the bath varies from three to ten minutes when given to relieve congestion. Longer applications at a high temperature would increase the blood supply in the pelvic vessels. When given to relieve retention of urine the duration may be until the condition is relieved.

SIMPLE CHEMICAL COUNTERIRRITANTS

A Mustard Plaster or Sinapism

Mustard is the ground seed of black mustard or sinapis nigra from which the plaster derives the name of sinapism. It has a variety of uses and is used in a variety of forms. It is used as a condiment, an emetic, a mustard plaster or paste, a mustard poultice, the mustard leaf, in a hot foot-bath, full bath or pack, as the oil of mustard, and with other ingredients, in compound liniment.

Action of Mustard.—In the dry form, as you can easily prove by smelling it or rubbing it on your hand, mustard has no irritant quality, but when combined with water a ferment or enzyme (myosin) breaks up a glucoside in the mustard flour into dextrose and an *irritant volatile oil.* All enzymes are destroyed by heat. The ferment in the mustard flour is destroyed by a temperature of 140° F. When the irritant effect of the volatile oil, therefore, is desired *tepid water* only should be added to the mustard flour.

Effects Produced by Mustard.—The use and action of mustard as a condiment are familiar to all. It causes an increased flow of blood, makes the mouth warm and increases the flow of saliva and gastric juice. If you take too much mustard it will make your mouth burn and it will also make the tears flow. If you take from a teaspoonful to a tablespoonful of mustard in a glass of warm water (an emetic) it will so irritate the lining of the stomach that the muscles in the wall of the stomach will contract forcibly and expel it with whatever else may be in the stomach; that is, vomiting will occur to get rid of the irritating substance. Now all of this is the result of reflex action: The irritation of nerve endings in the mucous membrane lining the mouth and the stomach stimulates nerve centers in the central nervous system which control and set in action the salivary glands, the tear glands, gastric glands, and the muscular wall of the stomach, so that irritation of the one causes an increased action in one or all of the others.

When the irritating volatile oil is applied to the skin the action is the same. It irritates nerve endings in the skin and this has a marked effect on the circulation and function of internal organs or deep-seated structures connected with that area of the skin through the central nervous system. When the skin becomes *warm and red* the desired effect on the internal organ has been produced. This is called counterirritation. For the action of counterirritants and for other counterirritants commonly used, see Chapter XXI.

Conditions and Purposes for which a Mustard Paste is Commonly Used: (1) Applied to the anterior or posterior chest to relieve congestion and pain in pneumonia or pleurisy, and to break up a cold; (2) applied to the precordium to stimulate the muscle of the heart when it fails to work and also to relieve pain; (3) applied to the epigastrium to check nausea and to relieve pain in the stomach; (4) applied to the abdomen to relieve the pain of colic due to flatulence; (5) applied to the lower abdomen to relieve pain and pelvic congestion; (6) applied to the forehead or the nape of the neck to relieve headache, neuralgia and cerebral congestion, and (7) to relieve pain due to muscular rheumatism or inflamed joints.

Method of Preparing and Applying a Mustard Paste.—A mustard paste is made by mixing, in the proportions ordered, mustard flour and wheat flour and adding sufficient *tepid water* to make a smooth paste, thin enough to spread, but not thin enough to run. It is spread on muslin, thick enough to prevent it from soiling the patient's gown (it may also be covered with a towel), and the edges are turned in sufficiently to prevent the escape of the mustard. The surface next the skin is covered with gauze or old muslin.

The *amount* of ingredients used will depend upon the area to be covered.

The *proportions or strength* vary according to the age, the sensitiveness of the skin, and the number of applications to be made. For an adult, the strength may be one part of mustard, modified by two or three parts of flour, or one in four or one in six. For a child the strength usually varies from one in eight to ten; for an infant, one in twelve. In the hospital wards it is safer to use the weaker applications. The burn caused by mustard is very painful and slow to heal. It often produces a permanent stain on the skin and may cause a permanent scar. Patients who have had applications while at home frequently enter with a well defined stain and sometimes with a severe burn. While there is no excuse for such a serious accident occurring, it is true that all patients do not react in the same way and, where the nurse's attention is necessarily divided, for the safety and comfort of the patient, and to avoid involving the hospital in a costly lawsuit, it seems wise to take every precaution.

Take the chill off the mustard paste before applying it. The feel of a cold, clammy mustard paste is most disagreeable as the involuntary shrinking of the patient indicates. Bring it to the bedside wrapped in a warm towel or a piece of old soft flannel or blanket, with a hot-water bag. This will take the chill off without interfering with the action of the oil.

The *duration* of the application varies; no set time can be given. It must be remembered that when the skin is well reddened it indicates that the desired effect has been obtained and therefore that the paste or leaf should be removed. This usually takes from ten to twenty minutes, but after the first five minutes the skin should be examined frequently. A burn or blister caused by a mustard paste is inexcusable.

A *mustard leaf or paper* (which consists of a preparation of mustard on muslin or paper) is cut to the required size, dipped in tepid water, allowed to drip for a moment or two, and applied directly to the skin. If the skin is tender it may be smeared with a thin layer of vaseline, or a thin layer of gauze or muslin may be placed between it and the mustard leaf. The application is then covered with a towel or with the flannel or blanket. It must be watched closely, as the skin usually becomes reddened in from four to eight minutes.

On *removal* of a mustard paste or leaf, examine the skin carefully. Be sure that no particles of mustard are left on it. To avoid this, some feel it wise to wash the part with warm water. If the part is very red and tender, olive oil or vaseline may be smeared over the part to lessen the irritation. A towel or gauze should then protect the patient's gown, etc., to avoid grease stains.

LOCAL APPLICATIONS OF COLD

Local applications of cold are frequently used in the care of the acutely ill but are also used for patients who are not acutely ill but suffering from minor ailments. They are also used for the chronically ill and convalescent. A young student nurse may serve and learn by observation and practice in assisting an older nurse in the care of the former and may be responsible, under supervision, for the latter. Local applications of cold may be in the form of an ice-bag, an ice-coil, cold compresses, and volatile sprays.

The application of an ice-bag or compresses seems a very simple procedure. The application itself is simple, but its effects may be widespread, affecting not only the skin, but internal organs and far distant parts. Its effects, according to the way in which the application is made, may be very varied. It may do a great deal of harm or good; it may decrease or increase the supply of blood to any part; it may be made to affect only superficial tissues or, in addition, some internal organ or distant part; and it may act either as a tonic or sedative to the part.

If an application is to be made intelligently, if it is to do good and not harm, it is important that nurses should understand the action of cold, the purpose for which an ice-bag or compresses may be applied, and the symptoms which indicate that the desired results are being obtained. A young student nurse may be given the care of a patient with heart disease for whom the only treatment, in addition to good nursing care, may be the application of an ice-bag to the region over the heart (precordia). Her care of the patient will be more intelligent, more conscientious, and more interesting to herself if she will only study her patient and observe the effects of the treatments applied.

Purposes for which Local Cold Applications may be Used:

1. To produce a purely local effect on the tissues to which the application is made.

2. To relieve inflammation, congestion, hemorrhage or pain in a distant or adjoining part by controlling the circulation to it.

3. By reflex action to produce the desired effect on some internal organ or distant part reflexly associated with the area of skin to which the cold is applied. The effect produced may be *primary* or *secondary*.

Discussion of Purposes for which Local Cold Applications may be Used:

1. To Produce a purely Local Effect on Superficial Tissues to which the Application is Made—Purposes of the Applications:

(a) To check inflammation and congestion; to prevent or reduce swelling; to relieve pain; to check bleeding and discoloration in such conditions as a bruise, wound, burn, sprain, fracture, acutely inflamed joint, hemorrhoids, phlebitis, tonsillitis, diphtheria, etc.

(b) To check inflammation and prevent suppuration or abscess formation in infected wounds, an infected finger, a stye, boil or abscess in a tooth or ear.

The Local Action of Cold on Superficial Tissues—The Primary Action of Cold:

(a) *On the Skin, Mucous Membrane, and Adjoining Tissues.*

(1) The cold first causes the numerous small involuntary muscles in the skin to contract and this gives it the appearance

of gooseflesh. The pressure exerted by these contracting muscles squeezes blood out from the skin capillaries.

(2) The cold, also, stimulates nerve endings in the skin and through these nerves the vasomotor center (the center in the brain controlling the size or caliber of the blood vessels) is stimulated and this center, in turn, causes the small blood vessels in the skin to contract, thus squeezing out more blood from the skin; this is called a reflex act.

(3) The result is less blood in the skin so that it becomes pale.

(4) Unless the application is prolonged, there will be more blood in the adjoining and underlying tissues, as shown in Figure 42.

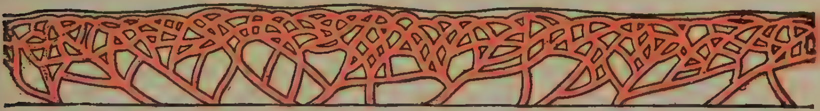

Fig. 40.—Congested Skin. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

(b) *On Nutrition and Activity of Cells.*—Cold is a vital depressant. It checks the activities of all living things. Its withering effects on plant life are familiar to all. It therefore checks the activities of the cells in the part.

(c) *On Bacteria.*—Cold checks the growth and activities of bacteria as they, like the body cells, are made of protoplasm. In this way cold checks inflammation and the process of suppuration, if present.

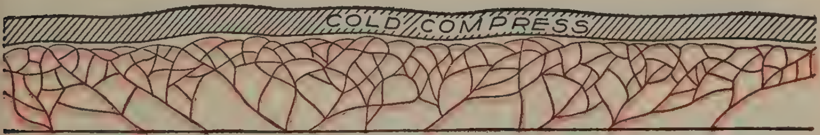

Fig. 41.—Cutaneous Vessels Contracted by a Cold Compress. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

(d) *On Inflammation and Congestion.*—An inflammatory process, if present, will be checked because, if you remember, the first step in this process is an increased supply of blood to the part. Thus there is less redness and heat in the part. Congestion, swelling, pressure on nerve endings, and pain are relieved.

The effect of cold applications on mucous membranes is the same as that on the skin, except that the mucous membrane, having fewer sensory nerves (nerves which carry sensations) is not so sensitive to either heat or cold.

The *local effect* may be seen by holding ice in the mouth. The lining will become pale; bleeding, if present, will be checked;

nerves will become benumbed so that the sensation of taste or pain is lost. A piece of ice held in the mouth before the administration of medicine with a disagreeable taste will make it much less distasteful. Dentists anesthetize or destroy the sensation of pain by freezing the gums, not by using ice, but a volatile liquid which in evaporating extracts heat from the gums so that they become frozen.

The Local Action of Cold if Prolonged:

(a) *On the Nerves.*—Cold applications if intense or continued for a number of hours will destroy all sensation in the part because cold depresses the activity of nerve tissue as it does that of all other tissues. Pain is thus relieved. Surgeons sometimes freeze the part by using ethyl chloride, a volatile spray, to cause insensibility to pain, in minor surgical operations such as incising a boil or an abscess. This is called a local anesthetic. This loss of sensation is due to the effect of cold on the nerve cells. It is thought that the cold causes the nerve cells to retract their branches which normally interlace (although quite distinct and not connected), and by means of which the messages are carried from nerve cell to nerve cell until they reach the brain. This retraction of the branches would interfere or "break the connection" just as an electric current or telephone message may be interrupted if wires are disconnected or broken.

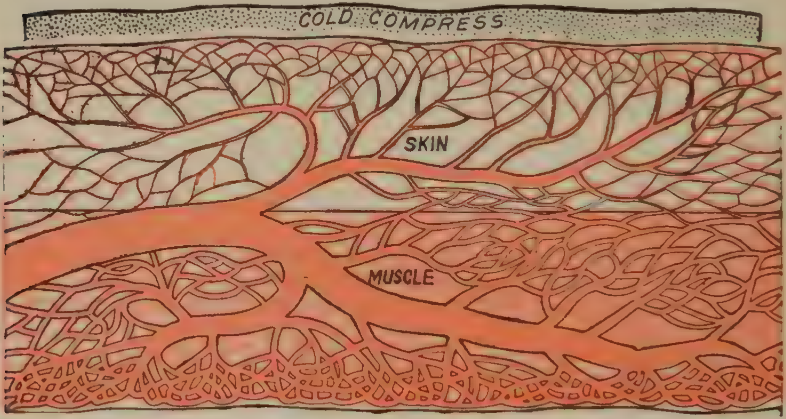

Fig. 42.—Anemia of the Skin with Collateral Hyperemia of the Underlying Muscle Produced by a Cold Application. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

If the nerves are completely benumbed, they will then fail to carry messages to the vasomotor center which will, therefore, fail to contract blood vessels in the skin.

(b) *On the Circulation.*—The thin, weak-walled veins first become exhausted, relaxed and congested, allowing venous blood to collect and preventing the entrance of fresh blood. The part becomes blue or purplish. If allowed to continue this would interfere with the supply of food and oxygen, lower the resistance of the cells, interfere with healing and even cause the death of the already damaged tissue.

(c) *On Nutrition and Function.*—Cold, if too prolonged, lowers the temperature and lessens the activities of the cells to such a degree that the function of the part may be completely lost, because a certain degree of heat is necessary for the chemical changes which mean life and work.

Prolonged applications cause a lowered temperature and lessened activity of the cells in adjoining tissues and muscles so that the part, the fingers, for instance, will become blue, numb, stiff and clumsy with the cold.

This depressing effect of cold on all living things is familiar to all. The sturdy plants wither at the first touch of frost—some never revive again, others revive with renewed beauty and vigor in the warm spring sunlight. You remember, also, how the bear sleeps away the long winter, during which time we are told the pulse may be only eight per minute and the respiratory chest movements entirely suspended. The use of ice to preserve food from decay by checking the activity and growth of bacteria is a common practice.

This interference with the blood supply, with the temperature, the activities, and function of the part will lower the resistance of the tissues, interfere with healing, and may even cause death of the part.

This danger of injury, death and sloughing of the tissues as a result of cold applications must always be remembered by the nurse and the first symptoms—a blue, purplish, mottled appearance of the skin, with numbness—should be reported to the doctor and the application removed. This indicates that the circulation in the part should be stimulated, not checked.

2. To Relieve Inflammation, Congestion, Hemorrhage, or Pain in a Distant or Adjoining Part by Controlling the Circulation to it.—Sometimes it is necessary to control the circulation in a part without making applications directly to it. This may be done by applying cold to the trunk of an artery between the heart and the injured part or to the blood vessels directly supplying it. For instance, an ice-bag in the axilla or bend of the elbow will check hemorrhage or relieve congestion in an injured hand; an ice-bag in the groin or bend of the knee will have the same effect on the leg or foot; cold to the throat, by contracting the carotid arteries, will relieve inflammation in meningitis, also sleeplessness or headache due to cerebral congestion or excess blood in the head; cold to the head and face will have the same effect. Cold to the face and back of the neck will relieve nasal catarrh or epistaxis (bleeding from nose); cold to the side of the neck below the jaw will sometimes relieve toothache and earache

3. By Reflex Action, to Produce the Desired Effect on Some Internal Organ or Distant Part Reflexly Associated with the Area of Skin to which the Cold is Applied.—The **Primary** or **Secondary** effect may be produced.

(a) The *Primary Reflex Action of Cold. Depressing Effect.*—It is thought that when the applications are made to a small skin area (as with an ice-bag) the effect produced on the internal organ reflexly associated with it is the same as that produced on the skin. The cold stimulates or irritates nerve endings in the skin, thereby stimulating the vasomotor center in the brain which in turn causes the contraction of the blood vessels in the reflexly associated internal organ.

The depressing effect on nerves, nutrition and function of cells, and the retarding effect on bacteria, on the circulation, and on inflammation and congestion are also the same. For instance, a cold application will check suppuration in the appendix in the same way that it checks the process in a boil.

The *purpose* of this *primary* or *first reaction* of the body to cold is an effort to protect itself from injury, from anything which interferes with its ability to "carry on." It is one of the body defenses. One of the functions of the skin is to regulate the loss of heat from the body.

When in contact with cold, therefore, the body must protect itself. The nerve endings (sentinels or guards) in the skin immediately warn their chiefs, the vasomotor and heat-regulating centers in the brain. These rally their forces which set about preventing any further loss of heat and producing more heat to make up for that lost. For instance, you gasp and shiver when in contact with cold, due to the contraction of muscles. This is Nature's way of producing more heat. Perspiration stops and the skin becomes pale because the blood vessels contract, driving the warm blood to internal vessels. This is Nature's way of preventing further loss of heat.

(b) *The Secondary Stimulating or Tonic Reaction.*—If the application has not been too prolonged, or if the tissues are not too depressed, they not only quickly resume all their normal functions when the cold application is removed, but in the enthusiasm of their defense, are stimulated to increased vital activities, as though "every knock were a boost." Sometimes even before the removal of the application, particularly if accompanied by friction, this tonic reaction sets in. We are all familiar with this tonic reaction as a matter of common experience. For instance, when first going out of doors on a cold winter's day, one may feel chilly and shiver. The face may look pale and pinched, and the teeth may even chatter. After a short time, however, in a healthy person this feeling of discomfort is replaced by a sensation of warmth, comfort, and well-being.

The Tonic Reaction.—The narrowing of the blood vessels in the skin and the stimulation of the vasomotor center, previously mentioned, each cause the heart to beat with increased force in order to overcome the resistance to the flow of blood caused by the contracted blood vessels. Thus the vasomotor center (which causes the contraction of blood vessels) and the heart are both stimulated and the circulation is improved. An abundance of warm blood is forced back into the capillaries of the skin, giving it a warm healthy flush. This internal application of warmth offsets the external application of cold so that the involuntary muscles of the skin relax somewhat, thus removing to a certain extent the pressure on capillaries and small blood vessels. The stimulated heart continues to drive more blood into the capillaries and small blood vessels. The muscles in the skin and blood vessels, however, keep up their tone and state of contraction, maintaining a certain pressure and resistance to further distention. The heart must continue to contract with force, and the contracted blood vessels keep the blood moving onward, so that increased blood with its nourishing and healing properties flows freely through the part and carries away with it all the waste products. Life is renewed and all the activities and defensive properties of the cells are stimulated, giving increased strength, vigor, and resistance in the part. This is the *tonic reaction.* It occurs not only in the skin and adjoining tissues, but in the internal organ reflexly associated with it. A pink, warm flush to the skin and the sensation of comfort following, together with the relief of symptoms and the improved function of the internal organ, are the indications that this tonic reaction has been produced.

This tonic reaction also occurs in nerve tissue. Sometimes we have cause to regret this. For instance, when the gums are frozen to extract teeth, and the tonic reaction sets in, the nerve endings will be much more sensitive to pain and the sensation will pass from nerve cell to nerve cell with increased ease and rate so that the pain may be unbearable. This is what makes a frozen part —fingers, ears, nose or toes, etc.—so very painful when, as we say, it is "thawing out." The nerves previously numbed have become increasingly sensitive and the blood, previously driven out of the tissues, returns in increased volume so that the part becomes red and swollen. This causes pain also, by pressure on the sensitive nerve endings. This tonic reaction also explains why frozen parts must be thawed out very gradually and why you should not come near the fire nor apply heat. The heat would relax the weakened blood vessels to such an extent that the blood would rush back in such increased volume that many capillaries would rupture and cause bleeding into the already severely damaged cells. The heat would also soften the tissues. The result would be death and sloughing of the part. To thaw the part gradually you rub with ice or snow so as to try to stimulate or revive the nerve endings and bring about a tonic reaction. This will keep up the tone and contraction of the vessels and allow a more gradual supply of blood and restoration of the circulation. The temperature of the part and activity of the cells will then gradually be restored.

If this tonic reaction does not occur, the tissues have been so injured and depressed that they have died and must slough away. Remember that this disastrous effect may be produced, through ignorance or carelessness on the part of a nurse, by intense or prolonged cold applications if not properly applied.

(c) *Alternate Applications of Heat and Cold.*—Sometimes hot and cold applications are applied alternately as in the treatment of a sprain; or a cold moist application may be made and allowed to remain on the part until warmed to body temperature and almost dried, then renewed by a second cold application. Such an application is frequently made to the throat in the treatment of tonsillitis. The effect is first a contraction and toning up of the blood vessels and lessening of the blood supply in the part, thus relieving congestion and pain. As the compress warms, the blood vessels again dilate bringing fresh blood to the part, while at the same time the warmth has a very soothing effect on the nerves. This alternate contraction and dilatation of blood vessels with the constant withdrawal of wastes and renewal of the blood supply gives great relief to the patient, stimulates the absorption of inflammatory products, and greatly promotes healing.

Conditions and Purposes for which a Primary Reflex Action is Desired:

(a) To contract blood vessels and check hemorrhage in internal organs.—An ice-cap, coil, or compresses may be applied to the head to check a hemorrhage in the brain as in apoplexy; to the chest to check hemoptysis (bleeding in the lungs and coughing up blood); to the epigastrium, to check hematemesis (vomiting of blood); to the abdomen, to prevent or check hemorrhage in the intestines in typhoid. The ice-coil is the most desirable form of application because it is light, flat and more adjustable, feels more comfortable, less of a burden, and ice-water can be kept flowing through it continuously so that the temperature is constant.

Applications used to check hemorrhage must be absolutely continuous until all danger is passed, otherwise there is apt to be a reaction with increased bleeding. (See secondary or tonic reaction.)

Authorities differ as to the penetrating effect of cold on the deep tissues. Some believe and feel that they have proved by experiments that the cold actually penetrates and affects deeper tissues. For instance, some believe that an ice-bag applied to the abdomen will in this way check hemorrhage in the intestines, while other authorities feel that their experiments prove that the deeper tissues are not affected in this way, but only by reflex action.

(b) To contract blood vessels in the head and relieve inflammation and congestion in meningitis, etc. An ice-bag is applied to the head in all general baths (either hot or cold) to contract the blood vessels so as to avoid possible congestion due to a sudden inrush of blood from the contracted skin vessels. An ice-bag or cold compresses to the head will also relieve headache or insomnia due to congestion or excess blood in the head.

(c) To relieve pain, inflammation and congestion of internal organs, cold may be applied to the chest, abdomen, or pelvis. In acute appendicitis with severe pain in the abdomen the application of an ice-bag will completely relieve the pain and "mask" the symptoms. For this reason, surgeons sometimes consider the application inadvisable because the patient's symptoms must be their guide in determining whether he should be operated upon immediately or not.

(d) To relieve vomiting and pain due to cancer or gastric ulcer cold may be applied to the epigastrium.

(e) To cause the contraction of the intestinal muscles and relieve distention in typhoid, the ice-coil may be applied to the abdomen.

(f) To depress the activity of the heart muscle when the pulse is rapid and irregular. A "continuous" ice-bag to the precordia (the region of the chest over the heart) will act as a sedative to the heart muscle, lessening its irritability and pain, making the pulse rate more slow and steady, thus resting the heart.

(g) To depress nerve centers as a sedative to the nervous system. An ice-bag or coil applied continuously to the head will depress mental activity (bone is a good conductor of cold). Either may, therefore, be used to lessen mental excitement, delirium or insomnia in meningitis, typhoid and other febrile conditions. This depressing effect of prolonged contact with cold is well illustrated in those frozen to death in whom it is well known that after the first intense suffering there is no consciousness of pain, but only of an irresistible desire to lie down and sleep.

Important Factors to Remember to Obtain the Primary Effect.—In making the above applications, in order to produce the desired effect (the *primary effect* of cold) on the internal organs, it is essential to remember the following important factors:

(a) The application *must be small* otherwise the desired reflex effect (contraction of internal blood vessels) will not be obtained. Large applications to the skin (particularly when made to the whole body as in a general bath) by contracting many blood vessels may drive in so much blood that the internal vessels cannot contract and may even become further congested. When the application is made to a small area the blood driven in by the contracted skin vessels is small in amount and is spread over the blood vessels of the whole body, whereas the reflex effect is

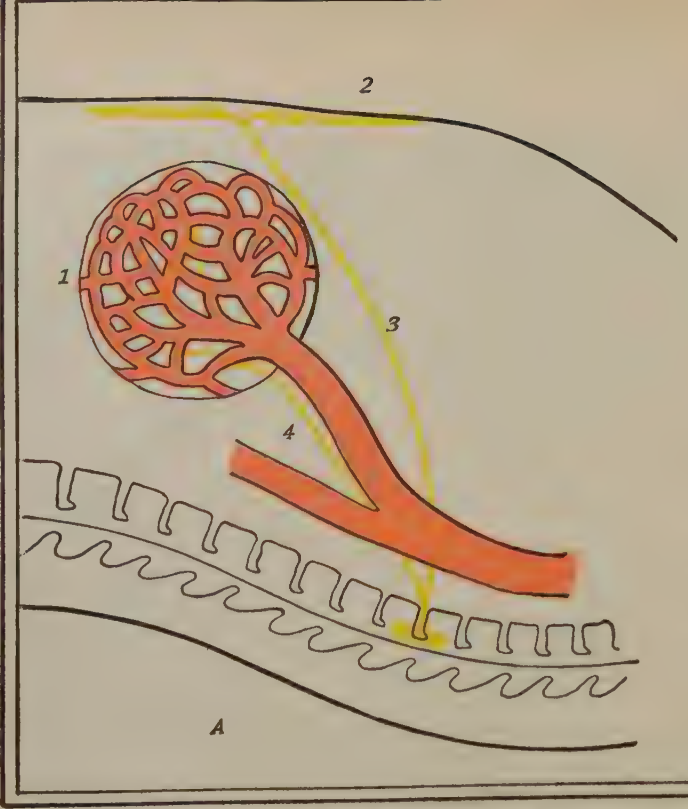

FIG. 43.—DIAGRAMMATIC ILLUSTRATION OF GASTRIC CONGESTION. 1, Arteries greatly congested. 2, Cutaneous area reflexly related with the stomach. 3, Nerve trunk connecting this area with the spinal center connected with the stomach. 4, Sympathetic and vasomotor nerves which transmit to the stomach the sensory impulses received from the skin. (From Kellogg's "Rational Hydrotherapy."

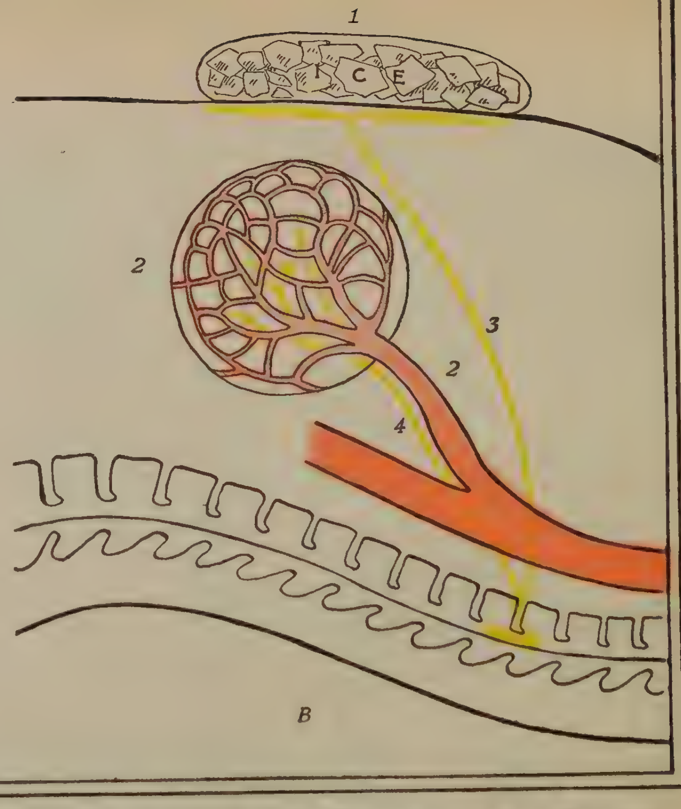

FIG. 44.—DIAGRAMMATIC ILLUSTRATION OF THE EFFECT OF COLD APPLIED TO THE CUTANEOUS AREA REFLEXLY CONNECTED WITH THE STOMACH IN CASE OF GASTRIC CONGESTION OR INFLAMMATION. (From "Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

concentrated on the internal organ reflexly associated with the skin area treated.

(b) The application *must be prolonged* in order to maintain the *primary effect*. Otherwise when the application is removed or if the temperature is not maintained, it will be followed by a reaction. This reaction is called the *secondary effect* of cold, or the *"tonic reaction."* This tonic reaction is frequently the reflex effect desired.

(c) While the applications may be prolonged, it is very important to watch for and avoid a bluish, mottled skin or numbness, not only because of danger to the tissues, but because no reflex effect can take place. When the nerves in the skin are benumbed they cannot carry any messages to the brain so that nerve centers are not stimulated and no reflex action occurs. Remember that the beneficial effect on the internal organs depends upon this reflex action.

To prevent loss of reflex action (and injury to the tissues), when an application must be prolonged, the doctor frequently directs that it be removed at stated intervals and the part rubbed until warm and red, or that a hot application be made to restore the circulation and activity of nerves. The skin should always be warm before cold applications are made.

(d) When cold applications are made to the head, chest, abdomen or pelvis to relieve inflammation or congestion, the feet must be warm. Cold feet will cause congestion in these parts. The reflex relation of the feet to the internal organs, upper respiratory tract and head explains why "getting the feet wet" seems to predispose to so many ills such as colds, pneumonia, cystitis, nephritis, intestinal catarrh, amenorrhea, and dysmenorrhea, etc.

Hot and cold applications are frequently used together. For instance, an ice-bag may be applied to the head to relieve a headache due to congestion, or a hemorrhage as in apoplexy, or to the abdomen to relieve inflammation and congestion in the pelvic organs, while hot applications are made to the feet to dilate the blood vessels and draw the blood away from the head or pelvis.

Conditions and Purposes for which a Secondary Tonic Reaction is Desired:

(a) To stimulate the heart.—*Short,* cold applications over the heart (an ice-bag applied for one-half hour three times a day or every two or three hours) act as a *tonic* to the heart muscle, slow the pulse, increase its force and raise arterial tension.

(b) To stimulate the nerve centers in the brain.—*Brief,* cold applications to the head cause increased mental activity. For instance, fresh air or dashing cold water in the face will arouse from fainting, and cold to the head, a bracing breeze, or breathing cold, fresh air will arouse from dullness or stupor. This explains why students in studying sometimes wrap a cold towel around the head. It also explains the importance of fresh air in such diseases as typhoid and pneumonia in which the vital nerve centers are poisoned and depressed by toxins, etc.

(c) To stimulate secretions, peristalsis and absorption in the digestive tract.—The habit of drinking a glass of cold water first thing in the morning, with some people, will prevent constipation due to the increased tone produced in the muscles of the intestines. This is the "tonic reaction" explained in a preceding paragraph.

Cold Applications Are Contraindicated in the Following Conditions:

(a) When the skin is already discolored showing a stasis and congestion of venous blood. Cold is usually applied only when the skin is red, that is, in the early stages of inflammation.

(b) When a large area of tissue has been injured as in an extensive bruise or burn or a wound in which the tissues around are bruised. In such cases many cells have been injured and the discoloration which quickly follows shows that blood vessels also have been injured, allowing the blood to escape into the tissues where it decomposes. Further interference with the circulation and nutrition may cause death of the tissues. Prompt stimulation of the circulation (usually by heat) may be necessary to prevent this.

(c) When pain is very severe. Heat usually gives greater comfort. The doctor is often guided, in the use of heat and cold, by the patient's sensations, that is, by which gives the greater relief.

(d) In inflammation of muscles and of the eyeball, in chronic inflammation of joints and deep-seated abscesses, in toothache or earache when the contraction of the blood vessels in the skin would increase the blood supply and congestion in the adjoining inflamed parts.

In all of the above conditions, heat is usually applied to stimulate the circulation, to bring fresh, healing blood and to carry away the dead cells and other wastes. Heat will promote the absorption of the waste products or will promote suppuration so that the dead mass or slough will be liquefied and separated from the living tissues in order that healing may more quickly take place.

Symptoms and Signs to be Avoided in Making Cold Applications.—A blue, purplish, mottled appearance of the skin, with numbness or stiffness of the part, indicates that the tissues are in danger of injury, death and sloughing. Should these symptoms appear, the application should be removed and the condition reported to the doctor. When these signs are present circulation in the part should be stimulated, not checked.

Application of an Ice-Bag

Conditions and Purposes for which an Ice-Bag or Cold Compresses are Commonly Used:

1. **For a Local Effect:**

(a) To check inflammation and congestion; to prevent or reduce swelling; to relieve pain; to check bleeding and discoloration in such conditions as the following: A bruise, wound, burn, sprain, fracture, acutely inflamed joint, hemorrhoids, phlebitis, tonsillitis and diphtheria, etc.

(b) To check inflammation and prevent suppuration or abscess formation in an infected finger or wound, a stye, boil, or abscess in a tooth or ear.

2. **For a Reflex Effect.**—An ice-bag may be used to give relief in a variety of conditions or diseases of internal organs. Patients suffering from such diseases are not, as a rule, assigned to a young student nurse. She may, however, be required to apply an ice-bag for the following purposes:

(a) To relieve pain, inflammation and congestion in an internal organ.—An ice-bag may be applied to the chest to relieve pain in pleurisy, or to the abdomen to relieve pain and check suppuration in appendicitis.

(b) To depress the activity of the heart muscle when the pulse is rapid and irregular. A "continuous" ice-bag to the precordia will act as a sedative to the heart muscle, lessening its irritability and pain. The pulse will become more slow and steady and the heart will be rested.

Method of Filling and Applying an Ice-Bag.—An ice-bag should be fitted to the part and should contain small, smooth pieces of ice or crushed ice only. It should be light in weight and, when used continuously, as in heart diseases, should be suspended to relieve the weight. A bandage, binder, or special suspender should be used to hold it in place and at the same time to relieve the weight. When used for the abdomen or an injured limb it may be suspended from a bed cradle so that it just rests on the part. When used for the head, it may be suspended from the head of the bedstead. The bag should not be more than half full. When filling the bag expel all the air both to lessen the weight and to prevent the ice from melting. If the air is not expelled the bag will not fit and remain in position. When in use, also to lessen the weight, expel the water which forms as the ice melts. See that the bag does not leak.

An ice-cap should never be applied directly to the skin. Lawsuits have been brought against doctors and hospitals because of injuries to the tissues produced in this way. A protector between it and the skin must always be used. Flannel is best because it protects the tissues from the rapid withdrawal of heat, and makes the application less intense, just as flannel protects from the cold in winter better than cotton. Flannel also absorbs the moisture of condensation which forms on the outside of the bag. A cover is necessary to prevent this moisture from wetting the bedding or the patient. The bag must be refilled when necessary so that the temperature of the application will be maintained.

Nothing annoys or discourages a physician and destroys his confidence in a nurse more than to visit a patient and find these applications, for which a nurse only can be responsible, improperly applied. For instance, it is most annoying to find the patient's gown and the bed linen wet and the patient uncomfortable and chilled from the leaking bag; the bag lying in the bed, on the bedside table, or displaced to some part of the body where it is not intended to be, the ice melted and the bag filled with warm water, or the patient exhausted from supporting its weight. A good nurse will never be found guilty of such carelessness or neglect.

COLD HEAD COMPRESSES

Method of Application.—Cold compresses to the head are usually applied to the forehead only. They may be used in addition to an ice-cap applied to the head. The compress may be made of several thicknesses of gauze or old muslin in order to retain the cold longer. If made of gauze all raw edges should be turned in so as not to annoy the patient. Compresses should be kept moist and changed frequently enough to maintain the desired temperature. A basin containing a block of ice and a small amount of water should be kept at the bedside. While one compress is on the head a second one should be moistened and placed on the block of ice so that it will be ready for use. The compress should be cold and moist when applied, but not moist enough to drip and dampen the pillow.

Cold compresses to the chest, and the application of an ice-coil are used chiefly for patients who are seriously ill. They are discussed in Chapter XXIV. Cold compresses to the eyes are discussed in Chapter XXXVII.

CHAPTER XVII

BANDAGES, BINDERS, ADHESIVE STRAPPING

BANDAGING

Bandaging is the art of applying bandages.

Purposes for which Bandages are Used.—Bandages are used in first-aid treatment, in orthopedic and in general surgery. They are applied for the following purposes: (1) To hold surgical dressings, medicinal applications, or splints in place; (2) to apply pressure on various parts in order to control bleeding, to support weak-walled blood vessels, to relieve congestion, to promote the absorption of fluid or exudates, and to prevent or reduce edema or swelling; (3) to immobilize a part, to afford support and protection to injured limbs and joints and to correct deformity.

Materials of which Bandages are Made.—Various materials are used, the most common being crepe paper, gauze, muslin, elastic webbing, rubber, woven cotton, canton flannel, flannel, and crinoline impregnated with plaster-of-Paris or starch. The material selected must be suitable for the purpose for which the bandage is applied.

Crêpe paper is cheap, light, smooth, and readily adjusted. It is suitable for bed patients and for home use.

Gauze is thin, light, soft, porous, and cool and can be readily adjusted with even pressure. It is suitable for holding dressings and splints in place. It is always used to retain wet dressings in place. It is usually used in preference to muslin in applying bandages to children. It is more pliable and stays on better and the soft tissues of children stand little pressure.

Unbleached muslin is heavier and firmer and may be used to apply pressure, to give support, to limit motion, and to hold splints in place. Sheet wadding is sometimes first wrapped around the limb when muslin bandages are applied for pressure and support.

Canton flannel is used under splints and plaster-of-Paris bandages to protect the skin. It is also used for abdominal and many-tailed bandages.

Flannel is soft and elastic and may be applied smoothly and with even pressure with simple spiral turns without reverses. It also absorbs moisture and supplies warmth.

Flannel is applied to painful joints and extremities in rheumatism and gout, etc., for the purpose of maintaining warmth and comfort. It is also sometimes used to apply even pressure in varicose veins, and to reduce swelling.

The *rubber bandage* (Esmarch bandage) is used to give support and apply pressure in varicose veins and to control hemorrhage. It may be applied smoothly, with even pressure by making simple spiral turns without reverses. Its disadvantage lies in the fact that it is expensive and is apt to become hot and uncomfortable because it does not allow for evaporation from the skin.

The *elastic bandage* is made of an elastic network covered with silk or cotton. It is used for the same purposes as the Esmarch bandage and is preferable as it allows for evaporation.

The *woven bandage* is made of cotton so woven that it will stand considerable stretching. It may be used for the same purposes as the rubber and elastic bandages. It has the advantage of being lighter, and less expensive and stands washing well. It makes even pressure, permits evaporation and has no odor. It is especially good for home use.

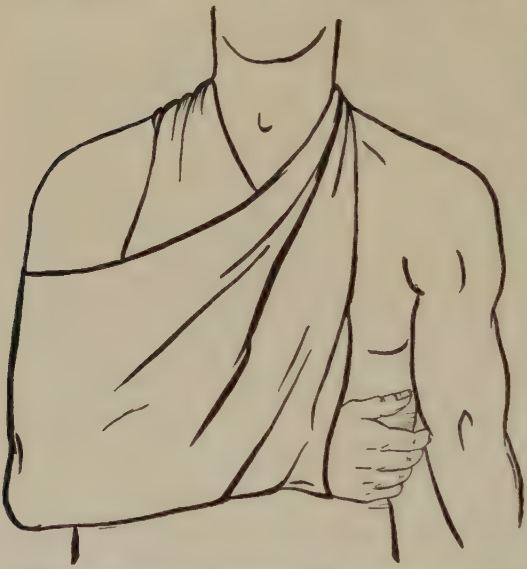

FIG. 45.——BRACHIO-CERVICAL TRIANGLE OR SLING.

Crinoline impregnated with starch or plaster-of-Paris is used to immobilize a broken limb or joint. It is also used as a means of support in diseases of bones or joints, such as osteomyelitis of the leg and a tuberculous ankle-joint. Space is left to allow for dressings.

Types of Bandages and their Uses:

1. The *triangular bandage* is used as a sling to support the hand and arm and may be used to hold dressings in place on the shoulder, hand, foot, hip, breast, or buttocks.

2. The *cravat bandage* is a triangular bandage in which the apex is first folded to the base and the material then rolled or loosely folded to the base making a bandage of the desired width. It is used as a sling to support the hand and in first-aid treatment to hold dressings in place on such parts as the axilla, groin, or back of the neck.

Slings.—A sling is a swinging bandage used most commonly to support the hand, forearm and elbow. It may be made of a roller bandage, a cravat, or a triangular bandage.

The *triangular bandage* is the sling commonly used. It may be made of any firm, pliable material but is usually made by folding a piece of muslin a yard square into a triangle.

Before applying the sling the injured arm is extended horizontally across the body, in the semiprone position, that is, with the thumb up. The triangle is placed under the injured arm so that the hand rests on the base and the apex extends beyond the elbow. The corner of the base of the triangle which rests against the body is carried up over the shoulder of the injured side while the other portion is carried up over the opposite shoulder. The two ends are then tied around the neck. The apex at the elbow is then folded neatly and pinned securely to the body of the bandage. Some surgeons prefer to pin it to the posterior portion while others pin it to the anterior portion.

The cravat sling is used when it is necessary to support the wrist and hand only.

3. The *handkerchief bandage* is made of thin, pliable material cut in squares of different sizes which can be folded in the shape of a triangle or cravat and readily adjusted to different parts of the body. The ends can be securely tied or pinned. The handkerchief bandage has been used for centuries. It is especially useful to secure temporary dressings on the head, hand, foot, knee, or elbow in first-aid and emergency work and for applications which require frequent attention.

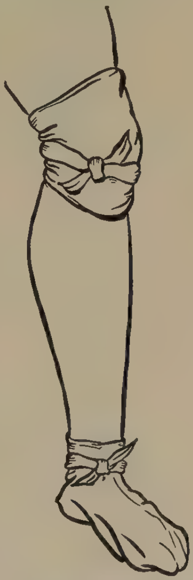
Fig. 46.—Knee and Foot Bandage.

4. *Tailed Bandages.*—These bandages consist of a body and one or many tails. The most commonly used are the *single* "T," or the *double* "T" bandage, the *four-tailed, six-tailed,* and *many-tailed* bandages. They are used to retain dressings and other applications, such as poultices, on various parts of the body. They are particularly useful when the patient is confined to bed, when a dressing requires frequent attention and changing, or when it is applied to a part which must be disturbed as little as possible as in the treatment of a wound in a fractured limb. The body of the bandage is used to cover the dressing, and the tails are used for fastening.

The *Single "T" Bandage or Binder.*—This bandage consists of a single upright strip which extends at right angles from the middle of a horizontal strip, thus forming the shape of a letter T. It is sometimes made of canton flannel, but is usually made of double unbleached muslin stitched around the edges. It is used to hold dressings in position over the rectum and external genitals. It is occasionally used for pressure.

A single T-binder is usually used for female patients. The belt or horizontal strip which fastens around the waist should be wide enough for comfort. The upright strip which passes between the thighs over the external genitals must be wide enough to cover the dressing and hold it securely in place in such a way that the dressing or wound will not become infected from external sources. This strip should be fastened securely to the belt with safety pins.

These binders must be changed immediately when soiled or dampened from perspiration or discharge from the wound, etc. There is nothing more uncomfortable, more unsightly and unsanitary than a soiled or narrow binder which soon curls up into a mere string.

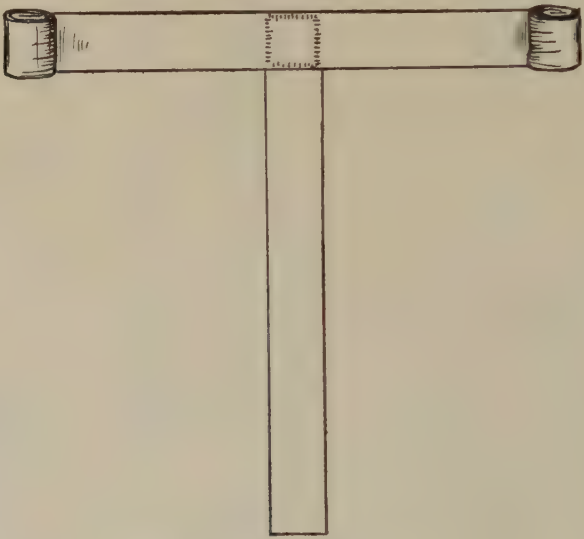

FIG. 47.—SINGLE T-BANDAGE.

Double T-Binder.—These binders are made of the same material and in the same way as the single binder but they have two upright strips instead of one. They are used for the same purposes as the single T-binder and are nearly always used for male patients.

The *four-tailed bandage* is used to retain dressings or applications on the head, chin, or knee.

The *six-tailed bandage* (sometimes called the bandage of Galen or the poor man's bandage) is an excellent bandage for covering a dressing to the entire scalp.

The accompanying illustration of a four-tailed bandage will show its construction and the principles of application and will suggest the various adaptations of its use which may be made.

The *Scultetus or many-tailed binder* is frequently used on the abdomen to retain dressings and to give added support following abdominal operations. It is used particularly after extensive operations when the muscle walls are thick or flabby or when the abdomen is pendulous, and when the patient is inclined to be restless. It prevents tension on the sutures and wound and so prevents pain. If properly applied it adds greatly to the comfort of the patient. If not properly applied or if not readjusted frequently it becomes loose, hot, and untidy, and is a source of discomfort. The binder is also used extensively in obstetrical work.

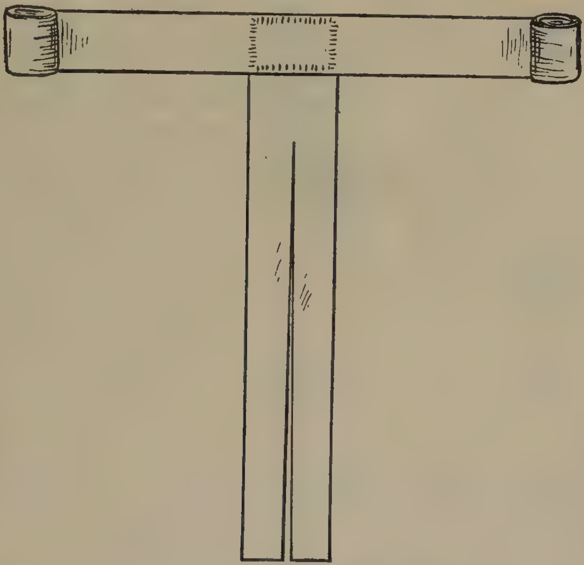

Fig. 48.—Double T-bandage.

The binder is made by placing five strips of canton flannel, three inches wide and about a yard and a half long, together so that each strip overlaps a half of the one below it. The strips are then sewn together for about a quarter of a yard. This forms the body of the bandage, the balance being the tails. It is sometimes strengthened by extra pieces of material sewn together with it. In applying the binder, the body is placed under the patient so that its lower border will come well down over the hips but not interfere with the use of a bedpan. The strips are then brought one by one from either side obliquely over the abdomen so that they cross each other directly in the midline. Considerable traction is used so as to give firm support, the patient's comfort being the guide as to the degree of traction used. There must be no wrinkles over the bony prominences of the hips and strips must not end on these prominences as they are apt to cause discomfort from pressure when the patient lies on his side and may cause pressure sores. When a binder is applied in a surgical case the pressure is usually made from below upward; that is, the lowest tails are applied first. In obstetrical work, that is, following childbirth, the tails are applied from above downwards, making a downward pressure.

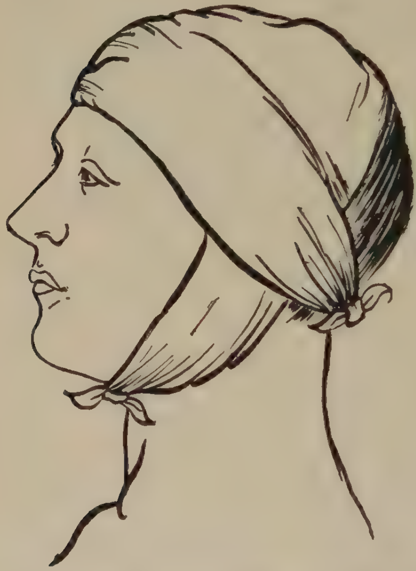

Fig. 49.—The Four-tailed Bandage of the Forehead and Top of the Head.

The Scultetus or many-tailed bandage may also be used on other parts of the body such as the chest or extremities when it is necessary to inspect or change dressings frequently without moving the part.

5. The *roller bandage* is the one most commonly used. It is made by cutting or tearing any of the above-mentioned materials into long narrow strips and rolling them into a compact cylinder. The width and length of the bandage will depend upon the part of the body to which it is to be applied.

Variations in Width and Length of the Roller Bandage.—The width and length will usually vary as follows:

	WIDTH.	LENGTH.
Finger	¾ to 1 inch	1 to 5 yards
Hand	1 to 2 inches	3 yards
Arm	2 to 2½ inches	7 to 9 yards
Head	2 to 2½ inches	6 yards
Eye	2 inches	3 yards
Foot	1½ to 3 inches	3 yards
Leg	2½ to 3 inches	9 yards
Body	3 to 6 inches	9 to 10 yards

How to Make and Roll Bandages.—Bandages must be free of seams, selvage, and ravelings and must be rolled tightly, evenly, and smoothly. It is impossible to apply a loosely rolled bandage satisfactorily. *Gauze* bandages are usually obtained rolled by machinery and are cut the desired width and the ravelings then removed. They may be obtained already cut in the desired widths. *Muslin, flannel* and *crinoline,* in the piece, are marked the desired width and then torn into strips in order to keep them even. Bandages are preferably rolled by machine or by a bandage roller. It is frequently necessary, however, to roll a bandage by hand and student nurses must practice doing so until they can roll a bandage tightly and evenly.

To make a roller bandage by hand, fold one end of a bandage upon itself again and again until a small stiff roll is formed, firm enough to grasp between the thumb and finger without bending. If this roll or core is not tight, it will be impossible to make a well-rolled bandage. This roll is then grasped between the thumb and index finger of the left hand while the free end is held tightly and firmly between the thumb and index finger of the right hand. The cylinder is revolved by the left hand, the right holds the free end firmly and acts as a guide to keep the bandage even. Some may find it easier to reverse this order, holding the roll in the right hand and the free end between the thumb and index finger of the left hand. Again, others may prefer to roll the bandage as shown in Figure 53. In this the right hand is held almost stationary while the roll is revolved by the left hand.

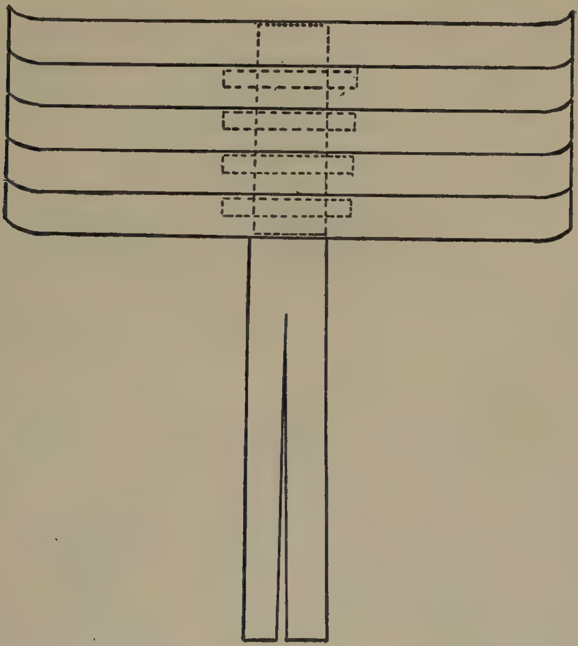
FIG. 50.—MODIFIED SCULTETUS BANDAGE.

Parts of a Roller Bandage.—The free end is called the initial extremity, the end in the center of the bandage, the terminal extremity, while the rolled portion is called the body. The surface of the bandage which lies next the roll and is toward you when the roll is held uppermost is called the inner surface, the other surface being spoken of as the outer surface. The roller bandage may be single or double. The double roller is made by rolling both ends of the bandage toward the center, making two rolls of equal size.

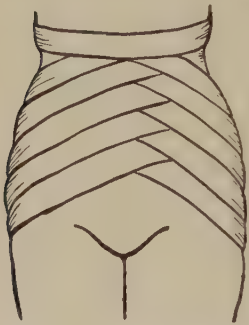

FIG. 51.—SCULTETUS APPLIED.

Principles to Observe in the Application of Bandages.—Bandaging is both an art and a science. Like all arts it requires much practice to acquire the necessary skill and dexterity. In applying the bandage, comfort and durability should receive the first attention. A bandage should never cause discomfort. In addition, the aim should be to secure ease in applying, economy in time and materials, and a neat, finished appearance. Comfort, durability, and neatness can only be attained by observing the following rules:

The patient must first be placed in a position comfortable for him and convenient for the nurse, who, in most cases, must stand *directly in front of the patient* in applying the bandage. Parts which are elevated in bandaging, such as a foot, leg, pelvis or head, must be properly supported. Sandbags, pillows, or special rests may be used for the heel, ankle, elbow, or pelvis, etc.

The part should be placed in its customary position and the bandaging applied with the part in the position in which it is to remain after the bandage is applied. For instance, in applying a bandage to the elbow the arm should not be extended but flexed at the elbow.

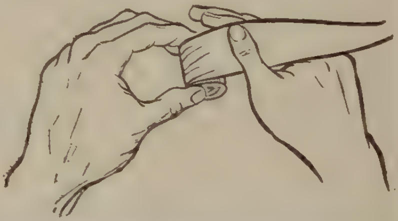

FIG. 52.—FIRST METHOD OF ROLLING A BANDAGE BY HAND.

Before applying a bandage to any part, see that it is clean, free from perspiration, and dry. Dust it lightly with powder. Two skin surfaces must never be allowed to come in contact. Non-absorbent cotton should be used in such parts as under the breasts, between the toes or fingers, between the arms and body, and behind the ear. A layer of gauze should be wrapped around the cotton to absorb any moisture from perspiration in order to prevent excoriation of the skin. Joints, bony prominences, and angles such as in the axilla, groin, bend of the elbow or knee, etc., where the bandage is likely to do harm from pressure and cutting, should always be padded. Hollows should also be padded.

In applying a bandage, the roll is always held uppermost. The outer surface of the initial extremity is placed on the part to be bandaged and is held in place by the fingers of the left hand while the body is held by the right hand. Never unwind more bandage than is absolutely necessary (unwind gradually as required) and bandage from right to left (with a few exceptions). Hold the bandage firmly to avoid dropping it. Always anchor a bandage securely by making two circular turns around the part. The second turn "fixes" or anchors the first.

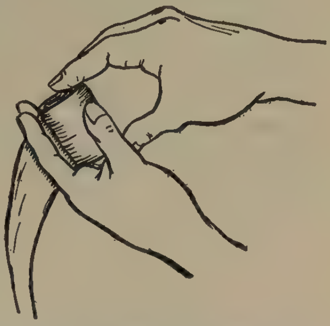

Fig. 53.—Second Method of Rolling a Bandage by Hand.

In bandaging a limb, begin at the extremity and work toward the trunk. This is in order to avoid congestion, swelling, and possible death of the part below. Fingers and toes are usually left exposed so that they may be observed from time to time as a guide to the condition of the circulation. If they become pale, cold, blue, tingling or numb, the bandage is applied too tightly and must be removed. Some surgeons, in order to avoid congestion of the hand and foot, always include them when bandaging an extremity. A bandage to any part is usually "fixed" or anchored by one or more circular turns.

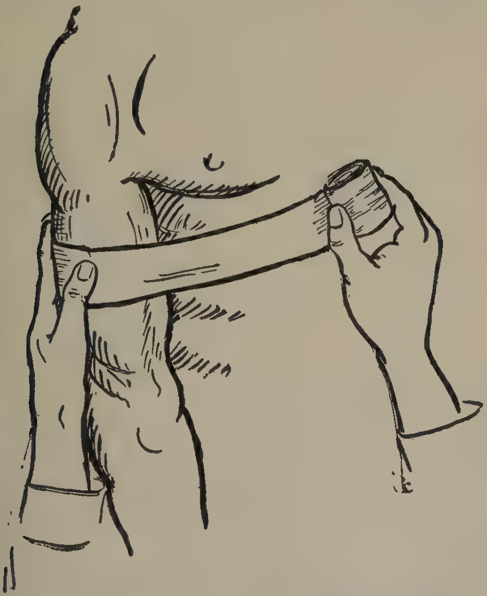

Fig. 54.—Method of Starting a Bandage.

Each turn of a bandage should be applied with even pressure or tension. The comfort of the patient and durability of the bandage depend to a large extent on the tension used. Good judgment is required in each case in order to know just how much pressure to make and considerable practice in bandaging is necessary before it can be secured. The degree of pressure required will depend upon the part bandaged, the condition of the part, and the purpose for which the bandaging is applied. The patient's comfort is one of the best guides. Always question the patient as to the comfort of the bandage, during the procedure and after its completion.

Pressure may be used over splints (because most of it is expended on the splint), over large, yielding dressings, and over hard, infiltrated, or edematous tissues. In bandaging a limb, a slightly greater pressure is used as the circumference of the part increases.

Pressure should not be used over inflamed, painful tissues and special care should be taken in applying bandages to infants and young children as their soft tissues stand little pressure. Care should also be taken in bandaging wet dressings in place as the bandage when wet will shrink and become unbearably tight. The bandage should be tight enough to insure permanency but not tight enough to interfere with the circulation and cause discomfort, swelling, and inflammation with danger of sloughing.

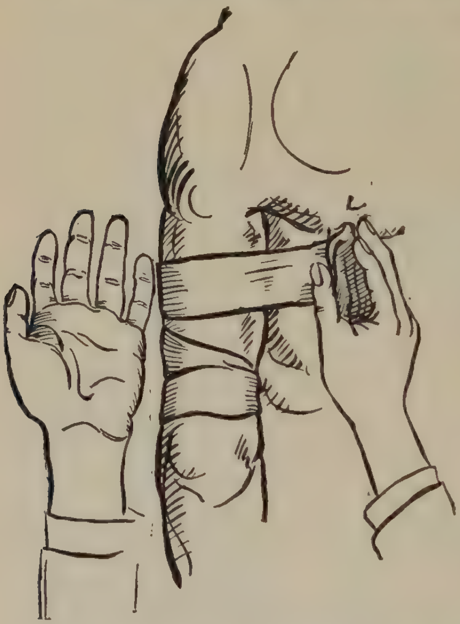

Fig 55.—Method of Removing a Roller Bandage.

In bandaging, avoid useless turns. This makes it uncomfortably hot, wastes the bandage, and makes the pressure uneven—each turn over the same region nearly doubles the pressure. Use a second bandage if necessary to complete a bandage but do not make extra turns just to use up a bandage.

Each turn should overlap exactly the same area of the preceding turn; the area covered is usually one-half or two-thirds. Reverses and crosses should always be even or in a straight line. Portions of skin (gaps between the turns) should never be left uncovered. If these rules are observed the desired pattern and finished appearance will follow; if they are not observed, the pressure will be uneven, the bandage will be uncomfortable, and will not stay on.

In applying bandages to the head, turn the exposed edge of each turn in so as to cover up the unfinished border and give a more finished appearance to the bandage.

Bandages should always be clean when applied.

Method of Securing a Bandage.—A bandage may be secured by pinning, by sewing, by adhesive strapping, or by tying. It should never be pinned or tied in the following places:—(1) Over an injured part or inflamed surface; (2) over a bony prominence, or on the inner surface of a limb; (3) in a part where the patient may lie on it; (4) in a part where there is apt to be friction or where it may cause discomfort in any way. Body bandages should be pinned in front, and head bandages over the temple.

Small safety pins are preferable to straight pins. When the latter are used, the point should be buried in the material to prevent scratching and catching on clothing. Pins should be inserted in the long axis of the bandage so that friction or straining will not remove but rather make it more secure. To tie a bandage, tear the terminal end the required distance, which depends upon the circumference of the part. Twist or tie the ends to prevent further tearing, and pass them around the part in opposite directions and tie at the starting point.

Method of Removing a Roller Bandage.—The bandage may be cut with bandage scissors when necessary to avoid pain or fatigue, or to save time in an emergency, or when the bandage is badly soiled. In all other cases unfasten the terminal end and unwind, gathering the loose turns as unwound and passing them from hand to hand. Otherwise the bandage will become entangled about the limb. This method also saves time and prevents the bandage from getting soiled.

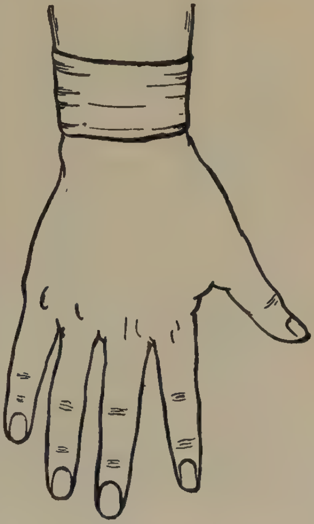

FIG. 56.—CIRCULAR BANDAGE OF THE WRIST.

Fundamental Bandages.—These are the circular, oblique, spiral, spiral-reverse, figure-of-eight, spica, and recurrent. These, together with combinations or modifications of these turns, form the basis for the greater number of bandages used. The form used will depend upon the part of the body bandaged and the purpose of the bandage.

The *circular bandage* consists of several circular turns of a roller bandage around a part, each turn exactly covering the preceding one. It is used to retain dressings on such parts as the neck, wrist, or forehead and one or two circular turns are always made to anchor the initial end of a bandage; each turn holds the preceding one firmly in place.

The *spiral bandage* is applied to parts of uniform circumference such as the upper arm, fingers, or trunk. It consists of simple oblique turns around the part, each turn ascending (or sometimes descending) higher than the preceding one and overlapping it one-half or two-thirds.

The *oblique bandage* consists of a series of turns around a part each one higher than the preceding one and separated from it by an area of uncovered skin. It is sometimes used to hold dressings lightly in place, to retain splints, and in starting a bandage.

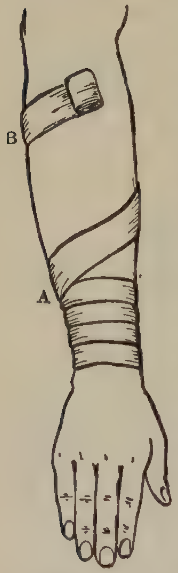

Fig. 57.—A, Slow Spiral Turn. B, Rapid Spiral Turn.

The *spiral-reverse bandage* consists of the spiral bandage in which "reverses" are made by means of which the bandage may be made to fit snugly parts which are tapering or of uneven circumference, such as the forearm or leg. When it is necessary to make a reverse in order to make the bandage fit, place the thumb of the left hand on the bandage where the reverse is to be made; the roll held in the right hand is unwound about six inches. The hand is then pronated so that the bandage is directed downward instead of upward (reversed). It is then carried around the limb with firm traction. The turns are continued, making sure that the reverses are uniform and in line and that each turn covers the same area of the preceding one. Otherwise the bandage will be uncomfortable and will not fit or stay on, and the pressure will not be even. Reverses should not be made over bony prominences or joints as they increase the pressure.

The bandage is used to retain dressings or splints in place and to apply pressure and afford support. It is used chiefly on the arms and legs.

The *figure-of-eight bandage* consists of oblique turns which alternately ascend and descend after encircling the part. Each turn crosses the preceding one in front, making a figure-of-eight, and overlaps it one-half or two-thirds. This bandage is used to retain dressings in place, to apply pressure and afford support, and is particularly useful in immobilizing joints such as the elbow, ankle, knee, wrist, thumb, hip, neck and axilla, or the head and neck. In affording support to a limb it is often combined with the spiral-reverse.

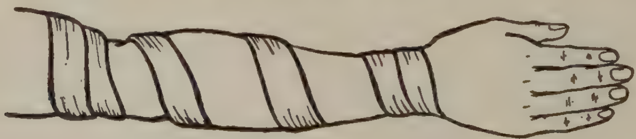

Fig. 58.—Oblique Bandage of the Arm.

The *spica bandage* derives its name from the fact that the turns are supposed to resemble the arrangement of the husks of an ear of corn. It is applied to the thumb, shoulder, groin, and foot. Each turn follows the preceding turn, covering two-thirds of it and either going higher or lower, according to whether the bandage is an ascending or descending spica. The turns cross each other, forming an angle or spica.

The *recurrent bandage* is used chiefly to retain dressings on the ends of the fingers, the head, or an amputation stump of a limb. It consists of a series of turns, the first turn usually being in the middle and the following turns passing back and forth over the part, first on one side, then on the other, each time returning (or recurring) to the starting point, until the whole area is covered. Each turn covers one-half to two-thirds the preceding one. The ends are bound down firmly with several circular turns.

BANDAGES APPLIED TO SPECIAL PARTS

BANDAGES OF THE UPPER EXTREMITY

Bandage of a Finger.—This bandage may be used to retain a dressing or splint in place. The finger alone may be included, or the bandage may be anchored by one or two circular turns around the wrist and carried obliquely across the back of the hand to the base of the finger to be bandaged. It is then carried by spiral turns to the tip of the finger, around which a circular turn is made, after which the bandage is carried by simple spiral, spiral-reverse, or figure-of-eight turns to the base of the fingers, across the back of the hand to the wrist, where it is secured by one or two circular turns. If the tip is to be covered, begin at the base of the finger with the bandage placed lengthwise and make one or two recurrent turns over the tip, holding them in place with the thumb and finger of the left hand. Then make a circular turn around the tip as before, and proceed in the same way. If the bandage is to cover the finger only, finish at the base by one or two circular turns. Where the finger only is included, a bandage one inch wide and one yard long will be required. When the bandage encircles the wrist two yards will be necessary. The spiral bandage is less bulky, takes less bandage, and is more quickly applied than the figure-of-eight.

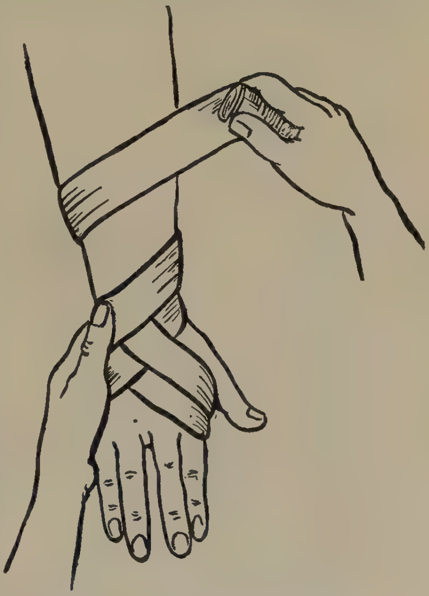

FIG. 59.—MAKING SPIRAL REVERSE IN BANDAGE.

Frequently, where one finger is injured, the surgeon will include two or sometimes three fingers in the bandage. The uninjured fingers serve to protect, support and limit motion in the injured finger, and so add comfort and promote healing. The fingers included must be separated by the dressing or by gauze or cotton.

Demi-gauntlet Bandage.—This bandage is used to hold dressings on the back of the hand in place. A bandage one inch wide and three to four yards long will be required.

It is anchored by two circular turns around the wrist. If the left hand is being bandaged, the bandage is then carried obliquely across the back of the hand to the base of the little finger around which a circular turn is made. It is then carried to the ulnar side of the wrist. (If the right hand is being bandaged, the first turn is around the base of the thumb and the bandage is carried to the radial side of the wrist.) A circular turn is made around the wrist and the bandage then crosses the back of the hand and encircles the base of the ring finger, returning to the wrist, which it again encircles before crossing to the base of the middle finger and so on until the back of the hand is covered. The bandage is finished by one or two circular turns around the wrist. The bandage must not be applied tightly enough to interfere with the closure of the fingers when completed.

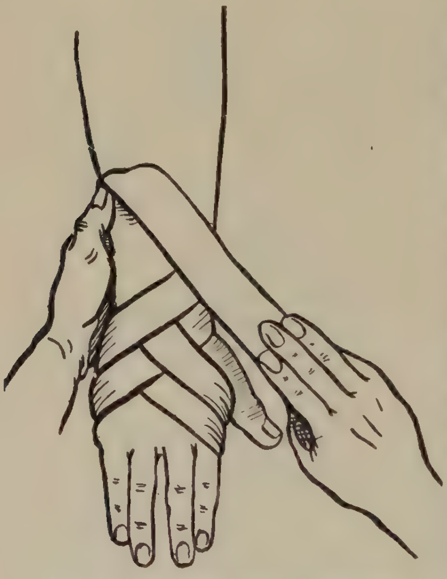

Fig. 60.—Making Spiral Reverse in Bandage.

Gauntlet Bandage.—This bandage is used to hold dressings on the fingers, following accidents such as burns and crushing injuries. A bandage one inch wide and five yards long will be required. The fingers are separated and the tips protected by the dressings.

The bandage is anchored by two circular turns around the wrist and (if the left hand is bandaged) carried obliquely across the back of the hand to the base of the little finger, around which oblique or spiral turns are made to its tip. A circular turn is made around the tip and the bandage is then carried to the base of the finger by spiral, spiral-reverse, or figure-of-eight turns, and then to the ulnar side of the wrist. After completely encircling the wrist, it is brought again across the back of the hand to the base of the ring finger, which is bandaged in the same way as the little finger. Similar turns are made until all the fingers and thumb are bandaged. The bandage is finished by circular turns around the wrist.

Spica of the Thumb.—This bandage is used to retain dressings or a splint applied to the thumb, or to afford support to the thumb when sprained or dislocated. A bandage one inch wide and three yards long will be required.

The hand is first placed in the semiprone position and the bandage is anchored by one or two circular turns around the wrist. It is then brought obliquely across the back of the hand and carried by spiral turns to near the tip of the thumb. A circular turn is here made and the bandage is carried by slow spiral turns to near the base of the thumb, then over the dorsum of the thumb to the radial side of the wrist, around the wrist and down over the back of the hand and thumb, around the thumb and back to the wrist, which is again encircled. These figure-of-eight turns around the thumb and the hand are continued until the thumb is covered. Each turn overlaps the preceding turn one-half its width. Circular turns around the wrist complete the bandage.

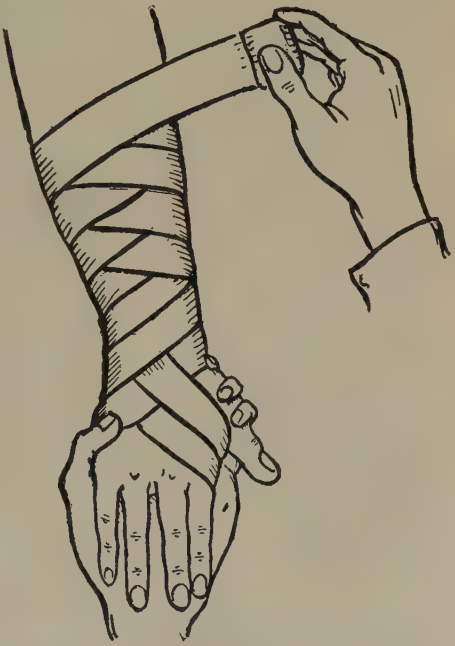

Fig. 61.—Figure-of-eight Bandage of the Forearm.

Mitten Bandage.—This is a bandage which includes the hand and fingers together, the thumb being left unbandaged, or bandaged separately. It is used to apply dressings to the fingers and hand when not necessary or advisable to bandage the fingers separately. It affords complete rest and protection to the part.

The thumb is covered first if it is to be bandaged. A bandage two inches wide and two to three yards long will be required for the hand. The fingers are separated and the tips protected with the dressing. The initial extremity of the bandage is placed lengthwise and well down on the back of the hand and several recurrent turns are made over the tips of the fingers, each turn covering the preceding turn one-half or two-thirds its width.

The turns are held by the thumb and fingers of the left hand. They are then secured by a circular turn around the fingers, the lower edge of the bandage crossing the second joint of the ring finger. The hand is then covered by figure-of-eight turns which alternately encircle the hand and the wrist, each turn overlapping half or two-thirds of the preceding one. In some cases (when the hand is long) it may be necessary to make one or two figure-of-eight turns around the hand before making the figure-of-eight around the wrist. In that case when the circular turn reaches the little finger carry the bandage obliquely upward across the hand, to between the index finger and thumb, overlapping the circular turn one-half or two-thirds. Then carry the bandage across the palm and down over the back of the hand to the index finger, crossing the former oblique turn in the midline and overlapping the circular turn half or two-thirds. Repeat these turns again if necessary. The bandage is completed by a circular turn around the wrist.

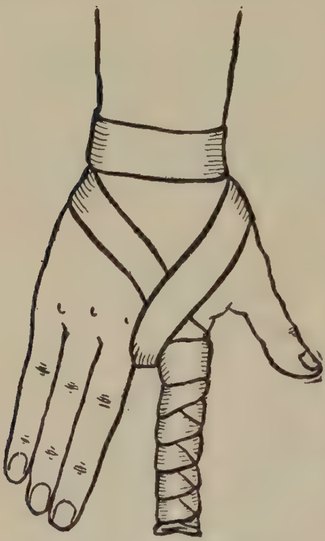
Fig. 62.—The Finger Bandage.

Bandage of the Hand.—This bandage is chiefly used to retain dressings on the palm or back of the hand. A bandage two inches wide and two yards long will be required.

The bandage is anchored by two circular turns around the wrist and is then carried across the back of the hand and the fingers, around which a circular turn is made, the lower edge of which crosses the second joint of the ring finger. The bandage is then completed by figure-of-eight turns around the hand and the wrist as described above.

In bandaging the hand padding should be placed in the palm to maintain the normal arch of the hand, and for comfort.

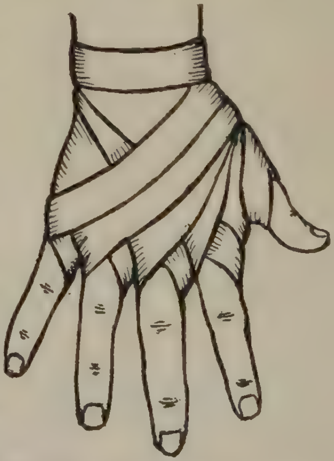
Fig. 63.—The Demigauntlet.

Bandage of the Forearm.—This bandage is used to retain dressings or a splint on the forearm. It should be two inches wide and five to six yards long.

The bandage is anchored by making two circular turns about the wrist. (Some surgeons always include the hand by making one or two figure-of-eight turns around the hand and wrist in order to avoid congestion and swelling of the hand.) Two or three ascending spiral turns are then made, changing to the spiral-reverse or the figure-of-eight when the shape of the arm requires it. The bandage is finished by one or two circular turns below the elbow.

When the figure-of-eight bandage is used for the forearm, a reverse is sometimes made in the upper loop under the arm, in order to make it fit the arm before making the descending turn.

Bandage of the Elbow.—This bandage is used to apply dressings or to support the elbow. It may be a separate bandage or a continuation of the bandage applied to the forearm.

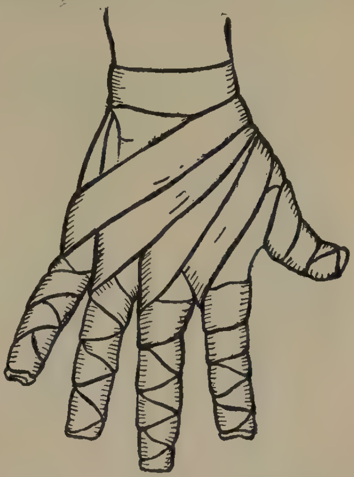

FIG. 64.—THE GAUNTLET BANDAGE.

When the bandage to the forearm is to include the elbow, the spiral-reverse or the figure-of-eight turns should be discontinued five inches below the elbow. The elbow should then be flexed and the bandage carried in front of the bend of the elbow and around it, so that the olecranon process is directly in the middle of the bandage. It is then carried down and around the forearm, overlapping half the last spiral turn, then in front of the elbow and around the upper arm, overlapping the circular turn over the olecranon one-half its width so that its lower edge is just above the point of the olecranon. The bandage is then carried in front of the bend of the elbow and around the forearm to the bend of the elbow, so that the upper edge of the bandage is just below the point of the olecranon. The bandage may be completed by one or two simple spiral turns around the upper arm, each overlapping half the preceding one, and finished by a circular turn.

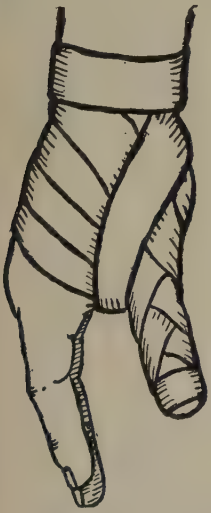

FIG. 65.—SPICA BANDAGE OF THE THUMB.

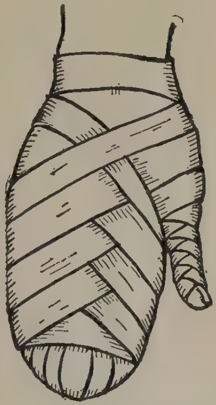

FIG. 66.—MITTEN BANDAGE.

If the elbow alone is to be bandaged two or three circular turns may be made around the flexed elbow so that the olecranon is directly in the middle of the bandage. The bandage is then carried around the forearm, so that the upper edge of the bandage is just below the tip of the olecranon, to the bend of the elbow, and around the upper arm so that the lower edge of the bandage is just above the tip of the olecranon. These figure-of-eight turns alternately descending and encircling the forearm and ascending and encircling the upper arm are continued until the part is covered. Each descending turn is a little lower than the preceding one and each ascending turn a little higher. Each turn overlaps half the preceding one. The bandage is completed by a circular turn around the upper arm.

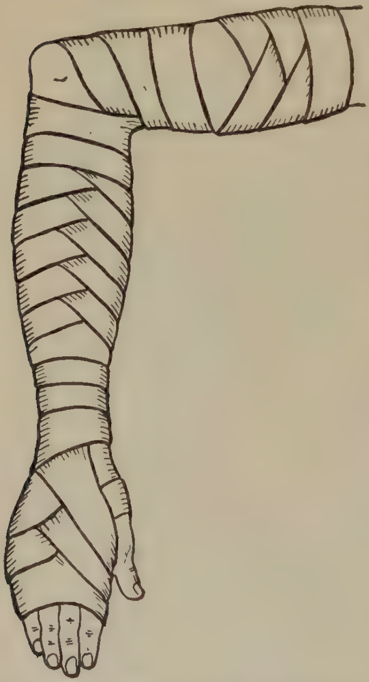

Fig. 67.—Spiral-Reverse Bandage of Upper Extremity.

Bandage of the Upper Arm.—This bandage is used to retain dressings or splints to the upper arm. It is anchored by two circular turns above the elbow and the arm is covered by the ascending simple spiral, spiral-reverse, or figure-of-eight, and completed by two or three circular turns around the arm.

Bandages of the Shoulder

Spica of the Shoulder.—This bandage is used to hold dressings on the shoulder and upper part of the arm. A bandage two and one-half inches wide and eight yards long will be required. The spica may be either ascending or descending. The ascending spica is the one more commonly used.

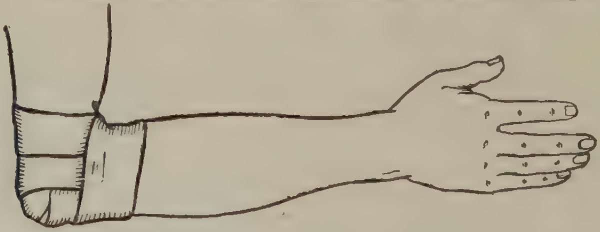

Fig. 68.—Figure-of-eight of the Elbow.

The *Ascending Spica.*—In applying the spica, stand exactly at the side of the patient. This is necessary in order to make each turn cross the preceding one directly in the midline of the shoulder. If this is neglected the bandage will slip and the dressing will not be secure. Padding should be placed in the axilla of both the injured and uninjured side as considerable pressure is made by the successive turns of the bandage. The bandage must be applied with the arm hanging in its normal position and never with the arm extended from the body.

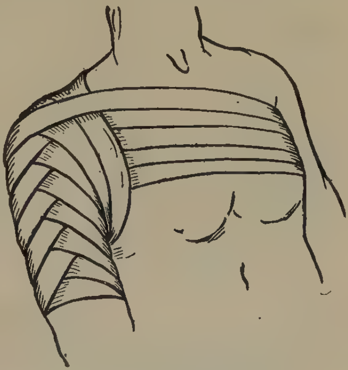

Fig. 69.—Ascending Spica of the Shoulder.

The bandage is anchored by two circular turns around the middle of the upper arm, on the injured side, and is carried by spiral or spiral-reverse turns to the axilla. It is then carried around the arm and across the chest (if the right side is injured), and across the back (if the left side is injured), through the opposite axilla and across the back (or chest, if injury is to the left side) to the injured arm, where it crosses the previous turn directly in the midline. Similar turns around the arm, and around the chest through the opposite axilla, are made, each turn overlapping one-half to two-thirds of the preceding one, crossing it directly in the middle line and each turn ascending higher on the shoulder until it is covered.

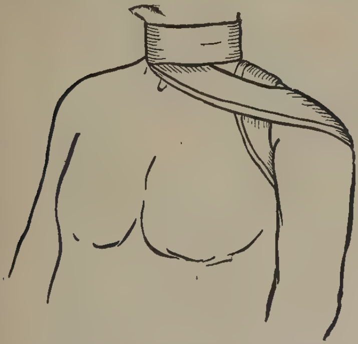

Fig. 70.—Figure-of-eight Bandage of the Neck and Armpit.

Bandage of the Neck and Shoulder.—This bandage is useful for retaining dressings in the axilla, on the shoulder, and side of the neck, as in infected glands of the neck. The bandage should be two or two and a half inches wide, and five yards long.

A figure-of-eight bandage is used, the turns alternately encircling the neck and the shoulder. Two circular turns are first made around the neck. If the dressing is on the right side, on reaching the back of the neck, the bandage is then brought across the right shoulder, through the axilla, and up over the back of the shoulder to the front of the neck. It is then carried around the neck and across the shoulder as before until the part is sufficiently covered.

When the dressing is on the left side, the circular turns are made as before but on reaching the front of the neck, the bandage is carried over and behind the left shoulder, through the left axilla, up over the shoulder to the back of the neck.

Velpeau Bandage.—This bandage is used in the treatment of fractures of the clavicle and scapula and in dislocation of the shoulder. It is also sometimes used in fractures of the elbow. Two bandages, each two and a half inches wide and seven yards long, will be required.

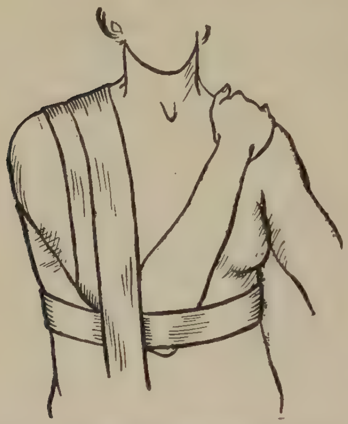

Fig. 71.—First and Second Turns of Velpeau Bandage.

The clavicle, which extends from the scapula to the sternum, forms the chief brace and support for the shoulder and arm. When it is fractured this support is removed and the weight of the arm drags the shoulder downward and forward on the chest. The purpose of the Velpeau bandage is to correct this deformity. To keep the shoulder elevated in the proper position the hand of the injured side is placed well up on the opposite shoulder. A pad is also placed in the axilla of the injured side, both to help raise the shoulder and to protect the skin surfaces. Particular care must be taken before applying this bandage to see that the skin is clean, dry and powdered. The axilla, the whole under surface of the arm and the chest should be powdered. A thin layer of cotton covered with gauze should be placed between the arm and the chest to protect the skin. Pads should be placed in the axilla, the bend of the elbow, over the injured bone, and in the palm of the hand of the injured side.

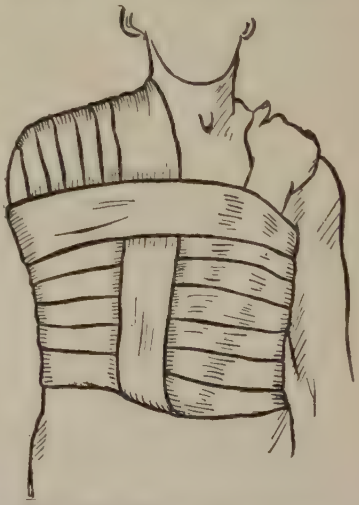

Fig. 72.—Velpeau Completed.

To apply the bandage the initial end of the bandage is placed over the scapula of the uninjured side. It is then carried over the tip of the shoulder of the injured side, down the outer surface of the arm, then around the arm beneath and supporting the elbow. It is then carried across the chest, up under the armpit of the opposite side to the starting point. This turn is repeated to anchor the bandage. On reaching the shoulder blade of the sound side the second time, the bandage is carried across the back, over the tip of the elbow, across the front of the chest, under the armpit and again to the shoulder blade of the sound side. From here it is carried over the injured shoulder, down the arm, beneath the elbow, across the chest and under the armpit to the starting point. A circular turn following the preceding one and overlapping it one-half is then made. The turns over the shoulder cover two-thirds of the preceding turn. These turns, first over the shoulder, then around the chest, are continued until the vertical turns reach the base of the neck and the circular turns reach the wrist. The hand is left free.

BANDAGES OF THE LOWER EXTREMITY

Toe Bandage.—This bandage may be necessary to retain a dressing on a toe. To apply it make two circular turns around the ankle. Then carry the bandage around the toe. Cover the tip, if necessary, with a recurrent turn and cover the toe with two or three spiral turns and finish with a circular turn around the ankle.

When several toes are injured as in burns and crushing injuries, the dressing would cover the tips of the toes and separate them. A foot bandage with recurrent turns over the toes (as in bandaging the fingers) would then be applied.

Bandage of the Foot.—This bandage may be used to retain dressings and to afford support. A bandage two to two and a half inches wide and three to six yards long, depending upon the distance it is to be carried up the leg, will be required.

In orthopedic work, in the treatment of "fallen arches," bandages are applied for pressure and support. When applied for this purpose it is essential that the tension or pressure of each turn shall be even and that downward pressure will be on the outer side of the foot and that firm traction should be made on the upward turn on the inside or arch of the foot. In this way the arch will be supported and a tendency to fallen arches or flat foot avoided or corrected. To accomplish this the bandage should always begin at the inner surface of the ankle or foot and work outward around the foot, the upward turn being on the inner surface or arch. The lower edge of the circular turns should encircle the foot at the roots of the toes (but never extend beyond) in order to give firm support to the metatarsal and phalangeal joints. In an advanced case of fallen arches in which the first metatarsal has fallen, a sharp angle will be formed at its joint with the first phalangeal so that the big toe projects sharply upward. In that case, to increase the pressure and support under this first joint, the surgeon may strap a piece of felt under it before applying the supporting bandage. The foot must always be supported comfortably and placed in its normal position; that is, flexion of the ankle to avoid "drop foot," and inversion, the outer surface of the foot downward and the inner surface upward and the arch maintained. It must be kept in this position until the bandage which is to maintain the position is complete. With the foot in this position, before applying the bandage a strip of adhesive is applied to maintain the proper position. The initial end is applied over the instep and the strap is carried outward, across the sole about the middle of the metatarsal bones or arch and upward over the instep, crossing the initial end and ascending obliquely upward in front of the ankle to the leg. Firm traction is made on the upward turn to support the arch.

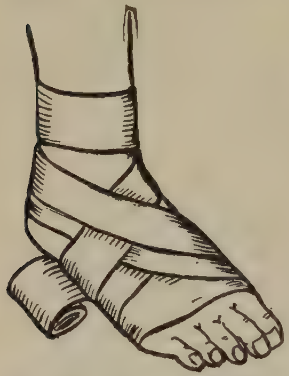

Fig. 73.—Spica of the Foot. First Turn Around Back of Heel.

Bandage of the Foot Not Covering the Heel.—Anchor the bandage by making two circular turns around the ankle. Then carry the bandage down the side of the foot and obliquely across the sole to the ball of the foot and up across the root of the toes. Make a circular turn and on reaching the instep make one or two spiral-reverse turns, depending upon the length and thickness of the foot and width of the bandage. From the instep then carry the bandage around the angle low down on the heel and back to the instep, crossing the preceding turn in the middle and overlapping it one-half to two-thirds. These figure-of-eight turns around the foot and the ankle, ascending higher on the foot and on the leg, are continued until the foot is covered. One or two circular turns around the leg complete the bandage.

Bandage of the Foot Including the Heel. — American method. — A bandage similar to this was used in the time of Galen (a famous doctor of the first century). It is the heel bandage most commonly used in America so is called the American bandage. It is used to retain dressings, including the heel, and to afford support and limit motion of the ankle.

The turns of this bandage are the same as those given above until the completion of the one or two spiral-reverse turns. From the top of the instep the bandage is carried directly over the point of the heel and back again to the instep. It is then carried down the outer side of the foot (left foot) across the sole, across the inner surface of the heel, behind the tendon of Achilles and

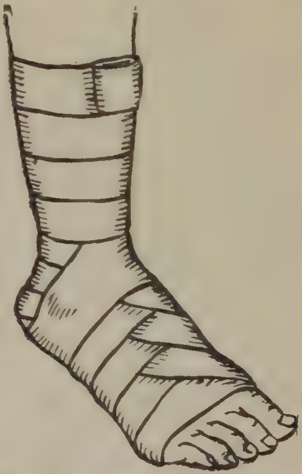

Fig. 74.—Spica of the Foot. Completed Bandage.

back to the instep. It is then carried down the inner surface of the foot, over the sole and across the outer surface of the heel around the tendon of Achilles and back to the front of the ankle, then to the leg, where it is finished by one or two circular turns. Strips of adhesive should be used to secure the cross turns on the heels.

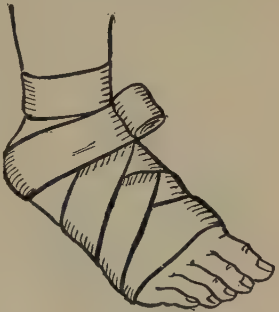

FIG. 75.—ANKLE BANDAGE WITH HEEL INCLUDED (American method). SHOWING THE TURN OVER THE POINT OF THE HEEL.

Bandage of the Leg.—This bandage is frequently used to retain dressings or splints and to apply even pressure and support, particularly in cases of varicose veins. A bandage two to two and one-half inches wide and ten to twelve yards long will be required.

The foot is always included in an extensive leg bandage in order to avoid congestion in the foot. The circulation in the lower extremity is apt to be poor. Either of the foot bandages described may be used. The first few turns on the leg may be simple spiral, changing to spiral-reverse or figure-of-eight when the shape of the leg requires it. The knee may be covered by figure-of-eight turns, as in the elbow bandage, and the upper leg may be covered with simple spiral, spiral-reverse, or figure-of-eight.

Each turn of the above bandages should overlap one-half the preceding turn. The reverses or crosses should always be made a little external to the shin or crest of the tibia in order to avoid pressure on this superficial part of the bone.

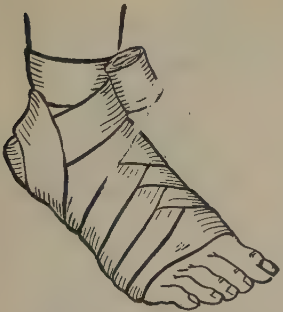

FIG. 76.—ANKLE BANDAGE. SHOWING BANDAGE PASSING TRANSVERSELY ACROSS THE OUTER SIDE OF HEEL.

Modified Figure-of-eight of the Calf of the Leg.—This bandage is commonly used to apply pressure and give firm support to the leg. It is more durable and gives greater security and support than the spiral-reverse and simple figure-of-eight. A bandage two or two and a half inches wide and ten or twelve yards long will be required.

The foot is bandaged by one of the methods already described. The bandage is then carried up the leg by two slow spiral turns and usually two or three spiral-reverse or figure-of-eight turns, depending upon the length and shape of the leg. It is then carried by a rapid spiral turn up the leg and a circular turn is made just below the knee to firmly anchor the bandage. The upper border of the bandage should cover the tuberosity of the tibia. The bandage is then carried by a rapid spiral down the side of the leg opposite to the ascending spiral. A plain figure-of-eight is then made, the lower loop overlapping the preceding turn one-half its width, the upper loop overlapping one-half the width of the circular turn below the knee. The figure-of-eight turns are repeated until the intervening space is entirely covered. Firm traction must always be made on the upward turn of the bandage so as to give upward support, especially over the calf muscles, where the circumference is greatest. The bandage is completed by one or two circular turns below the knee.

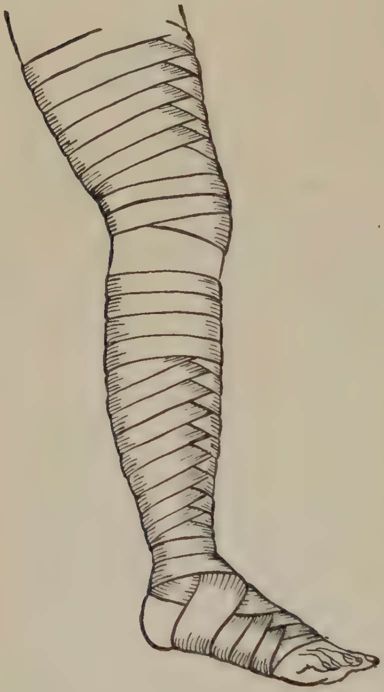

Fig. 77.—Spiral-Reverse of Lower Extremity.

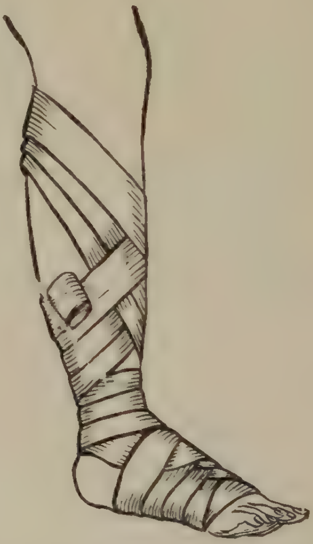

Fig. 78.—Figure-of-eight Bandage of the Leg. Method 1.

Ascending Spica of the Groin.—This bandage is used to retain dressings on the groin and sometimes for support. A bandage two and a half or three inches wide and eight yards long will be required.

The initial end of the bandage is anchored by two circular turns around the thigh just below the groin. In bandaging the right groin, on reaching the outer surface of the thigh, the bandage is carried obliquely across the pubes to the crest of the ilium on the opposite side. It is then carried around the back and obliquely down toward the inner surface of the thigh so that it crosses the preceding turn slightly to the inner side of the median line of the thigh. Care must be taken that no area of skin is left uncovered where these turns cross. The bandage is then carried around the thigh, covering one-half the width of the circular turn. It then follows the preceding oblique turn, overlapping it one-half. These figure-of-eight turns, alternately encircling the pelvis and the thigh, are repeated until the dressing is covered and secured.

Double Spica of the Groin.—This bandage is used to retain dressings on both groins and to give support. Plaster-of-Paris bandages are used to immobilize the pelvis and hip joint in fracture of the pelvis or coccyx and in fracture or dislocation of the hip joint. Two roller bandages, each two and a half inches wide and six yards long, will be required.

To apply the bandage, anchor the initial extremity by two circular turns around the right thigh close to the groin. From the outer surface of the thigh carry the bandage obliquely across the pubes to the crest of the ilium, across the back and obliquely downward across the front of the pelvis to the outer surface of the left thigh. The oblique ascending and descending turns on the abdomen should cross each other in the median line of the body below the umbilicus. From the outer surface of the left thigh the bandage is carried around the thigh and on reaching its inner surface, is then carried obliquely upward to the crest of the left ilium, then across the back, obliquely downward to the inner surface of the right thigh and

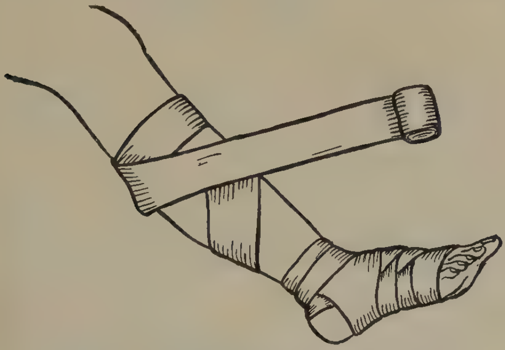

Fig. 79.—Figure-of-eight Bandage of Leg. Method 2.

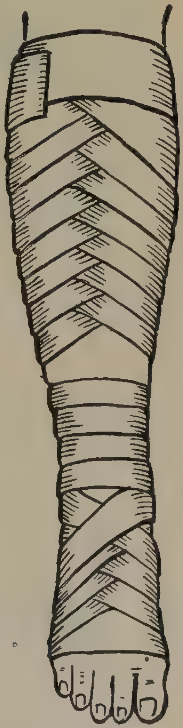

Fig. 80.—Figure-of-Eight Bandage of the Leg.

around to its outer surface. These turns are repeated until the bandage is completed.

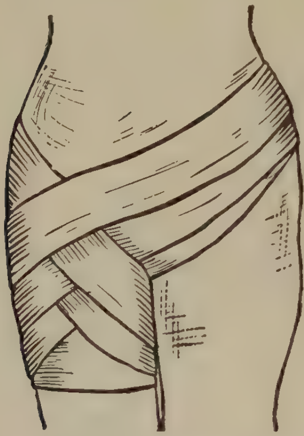

FIG. 81.—ASCENDING SPICA BANDAGE OF THE GROIN.

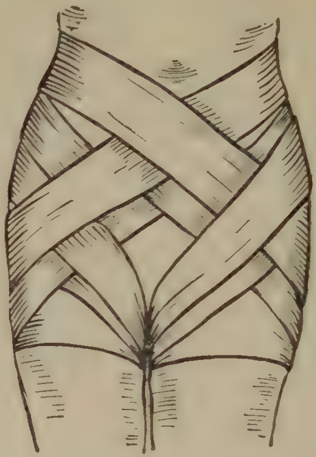

FIG. 82.—DOUBLE SPICA BANDAGE OF THE GROIN.

BANDAGES OF THE HEAD

Bandage of the Back of the Head and Forehead.—This bandage is used to retain dressings on the forehead or on the back of the head. A bandage two inches wide and five yards long will be required.

Place the initial end of the bandage above the right ear and carry it obliquely over the head above the forehead, above the left ear, beneath the occipital protuberance and upward to the starting point. Repeat this turn to anchor the bandage. Make a similar turn around the head overlapping one-half the preceding turn descending lower on the forehead and ascending on the back of the head. A third similar turn, overlapping one-half the second turn, descending on the forehead and ascending on the occiput, completes the bandage.

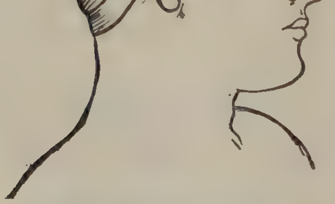

FIG. 83.—OCCIPITO-FRONTAL BANDAGE.

Bandage of the Head and Neck.—This bandage is used for retaining dressings or applications to the back of the head or neck as in the application of dressings or a flaxseed poultice in the treatment of boils. A "V" or figure-of-eight bandage is used. It should be two inches wide and five yards long.

To apply it make two circular turns around the neck. Then carry the bandage up behind the right ear, around the forehead and down above the left ear and across the head. These turns around the neck, alternating with turns around the head, are continued until the dressing is covered and secure. Finish with a circular turn around the neck.

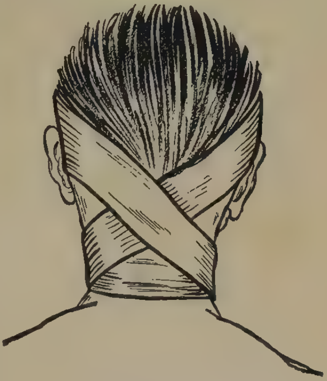
Fig. 84.—Figure-of-eight Bandage of the Head and Neck.

Barton Bandage.—This bandage is used in fractures of the lower jaw and to hold dressings in place on the chin. It was devised by the "ingenious surgeon," John Rhea Barton. A bandage two inches wide and five yards long will be required.

The initial end of the bandage is placed at the nape of the neck below the occipital protuberance and is carried obliquely up behind and close to the left ear to the top of the head. It is then carried down the right side of the face, in front of and close to the ear, then under the chin and up in front of the left ear to the top of the head where it crosses the first turn directly in the median line and proceeds behind the right ear to the starting point at the nape of the neck. Here it crosses and anchors the initial extremity and is carried under the left ear, over the chin, under the right ear and again to the starting point. These turns are repeated three times to make the bandage secure. Each turn exactly covers the preceding turn, the bandage being completed by the turn which goes under the chin and crosses on the top of the head, where it is pinned or secured by adhesive. The bandage should also be secured by adhesive at the points where the turns cross at the sides of the chin and nape of the neck.

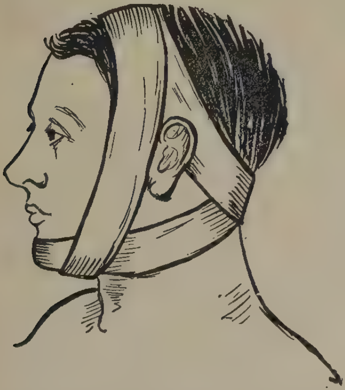
Fig. 85.—Barton Bandage.

Recurrent Bandage of the Head.—This bandage is used to retain dressings on the head in the treatment of extensive scalp wounds. It may be applied with a single or double roller and the recurrent turns may be longitudinal or transverse. Considerable practice will be necessary in order to apply a bandage to the round ball of the head so that it will stay on, the test being not to be able to pull it off the head by pulling it up from the neck. The transverse recurrent is less liable to displacement than the other recurrents and can be more firmly applied.

Recurrent Bandage of the Head with a Single Roller.—A bandage two inches wide and six yards long will be required. Place the initial extremity of the bandage above the right ear and carry the bandage across the forehead, above the left ear and well down on the nape of the neck so that its upper edge is below the occipital protuberance. The bandage will not stay on if this rule is not observed. Then carry the bandage to the starting point above the right ear and repeat the turn so as to firmly anchor the bandage. On reaching the middle of the forehead on the last turn the bandage is reversed and held in place by the thumb or finger of the left hand while the bandage is carried over the midline of the top of the head to the nape of the neck below the occipital protuberance. At this point the bandage is either pinned or held by an assistant. It is then reversed and carried across the top of the head, overlapping one-half the first turn, to the starting point in the middle of the forehead, where it is again reversed and carried back to the nape of the neck on the other side of the median turn overlapping it one-half its width. These reverse turns are repeated first on one side, then on the other, until the whole head is covered. The bandage is then completed and the reverses secured by two horizontal circular turns. Adhesive strips or pins should be used to secure the reverses at the forehead and nape of the neck. A strap made of bandage pinned to the circular turns in front of one ear, extending under the chin and pinned to the circular turns in front of the ear on the opposite side, will make the bandage more secure.

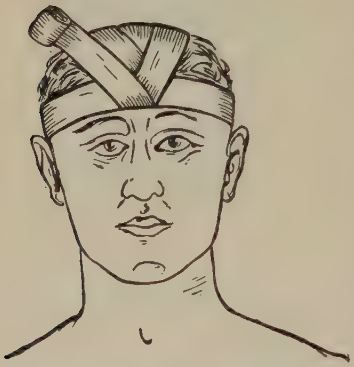

Fig. 86.—The Application of a Recurrent Bandage with a Single Roller.

Recurrent Bandage with a Double Roller.—This bandage is called the capeline bandage, which means a hood-bandage to a stump or rounded extremity. It is one of the oldest known bandages and is said to have been found on the most ancient mummies.

A double roller about six yards long and two inches wide will be required. One roll, the one which is to cover the head, may be a little smaller than the roll which is to encircle the head.

To apply it place the bandage in the center of the forehead and carry the rolls in opposite directions to the nape of the neck below the occipital protuberance. The smaller roll, which should be beneath and crossed by the larger, is then reversed and carried obliquely over the side of the head to the middle of the forehead. The large roll is carried horizontally around the head to the middle of the forehead where it again crosses the oblique turn made by the small roller. The small roll is again reversed and carried obliquely over the opposite side of the head to the reverse at the back of the head. Each of the above oblique turns overlaps a half to two-thirds of the circular turn made by the large roller. The large roll continues its turns around the head, each turn covering exactly its preceding turn and crossing the small roller in the center of the forehead and nape of the neck. The small roller is reversed each turn where it is crossed by the larger roller and carried obliquely over the head, first on one side, then on the other, each turn overlapping the preceding one and ascending higher on the head until it is completely covered. The bandage is completed by two circular turns around the head with the large roller.

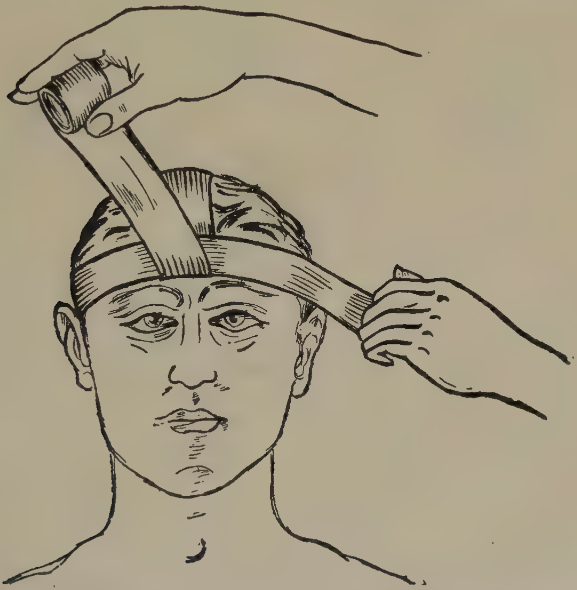

Fig. 87.—The Application of a Recurrent Bandage with a Double Roller.

This bandage may be applied, if desired, by making the first turn with the small roller directly over the median line of the top of the head. The following turns are made first on one side, then the other, so that the head is covered from the top to the sides instead of from the sides to the top, as explained in the above bandage.

Transverse Recurrent Bandage of the Head.—A bandage two inches wide and seven yards long will be required. The bandage is anchored by two circular turns similar to those used when beginning the longitudinal recurrent bandage. The same emphasis must be placed on having the turns below the occipital protuberance. When the bandage on the second turn reaches a point directly above the right ear, it is reversed and carried over the top of the head to a point above the left ear. The bandage is held here by an assistant and is reversed and carried transversely across the head, overlapping a half of the median turn, to the starting point on the opposite side, where it is again reversed and carried transversely across on the opposite side of the median turn. These transverse recurrent turns first on one side, then on the other, are repeated until the whole scalp is covered. The bandage is finished and the reverse turns secured by two circular turns around the head covering the previous circular turns. Sometimes a strip of adhesive extending over the top of the head from the middle of the forehead to the nape of the neck is used to make this bandage more secure.

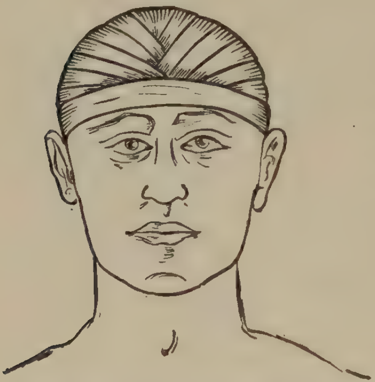

Fig. 88.—Longitudinal Recurrent Bandage of the Head.

Bandages for the Eyes.—Bandages to the eyes are never applied without direct instructions from the surgeon. When the eyes are inflamed, a bandage increases the heat and congestion and causes great discomfort. It also causes any discharge present to be retained in the conjunctival sac.

They are used to retain dressings on the eye and for protection following operations on the eye and sometimes for pressure and support as in ulcers of the cornea when perforation of the cornea is feared. When applied for protection only, they must be applied lightly; when for pressure and support, they are applied firmly.

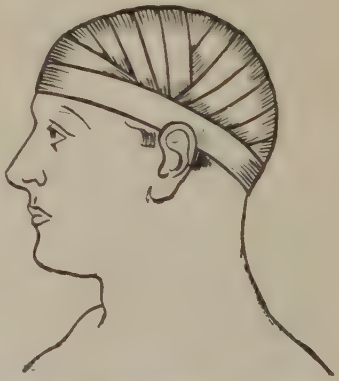

Fig. 89.—Transverse Recurrent Bandage of the Head.

In all cases the eyes must be protected and the orbital cavity or depression between the supraorbital margin and the nose must be properly filled, especially when pressure is to be applied. This keeps the lids securely closed, allows slight compression to be made, and helps to steady the eyeball, in this way securing rest. Rest of an injured or diseased part of the body is essential to recovery.

The turns of a bandage covering the eye should be applied from below upward so they will be removed from above downward, in this way lessening the danger of opening the eyelid owing to an adherent dressing. When the ear is partially or completely covered (the tip is seldom covered), it should be protected by cotton placed behind and over it. Its position must be normal, neither pushed forward nor upward.

Bandage for One Eye.—The Monocular or Monocle Bandage.—A bandage one and one-half to two inches wide and from five to seven yards long will be required. It may be made of gauze, muslin, or flannel, according to the object desired.

The figure-of-eight bandage is the one most commonly used. To apply the bandage to the right eye, begin at the right temple and carry the bandage above the left ear to the nape of the neck, then above the right ear to the starting point. Repeat this turn to anchor the bandage until reaching the nape of the neck. Then carry the bandage under the right ear and over the cheek and right eye so that its lower edge just crosses the roof of the nose. Then carry it up obliquely over the parietal prominence to the neck and make a complete circular turn around the head, covering the first turns made. On reaching the occiput again, carry the bandage under (or over, if necessary) the right ear, over the cheek, eye, forehead, and head, overlapping one-half of the preceding turn and higher up on the cheek but lower on the head. These figure-of-eight turns, alternately encircling the forehead and obliquely covering the cheek, eye, and head, are continued until the eye is sufficiently covered. Two or sometimes three turns over the eye are usually all that are required. The bandage is finished by one or two circular turns.

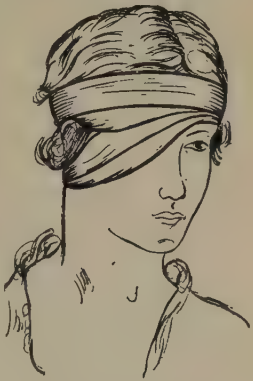

Fig. 90.—Monocular Bandage.

Bandage for Both Eyes.—The Binocular or Binocle Bandage.—This bandage is used frequently after operations on one eye when it is necessary to keep the eye absolutely at rest. One eye cannot be at rest unless rest of both is secured.

The figure-of-eight bandage is used as above. After making the first oblique turn over the cheek, injured eye and the head, and fixing this by the circular turn around the head, the bandage is brought down over the unaffected eye, under the left ear to the occiput. The lower edge of the bandage must just cross the root of the nose. These double figure-of-eight turns are continued until both eyes have been sufficiently covered. The bandage is completed by one or two circular turns.

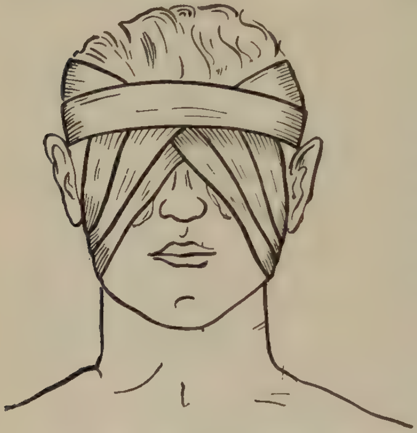

FIG. 91.—BINOCULAR BANDAGE.

Bandage for the Ear.—This bandage is used to retain dressings on the ear. The dressing must be so arranged that the ear will be properly protected and remain in its natural position. Gauze compresses may be cut to encircle the auricle and separate it from the scalp. The bandage should be applied so as to carry the ear backward against the head. When applied in the opposite direction the tendency is to carry the auricle forward and possibly close the meatus.

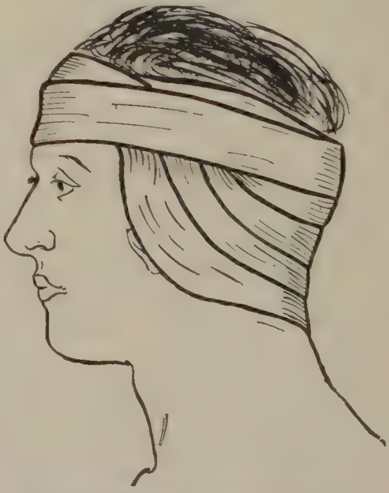

FIG. 92.—BANDAGE OF THE EAR.

To apply the bandage, begin by placing the initial extremity above the ear on the side opposite to the dressing. Carry the bandage over the dressing to anchor it, under the occipital protuberance, above the right ear (if the left is being bandaged) and around to the left temple. A second turn should be made to anchor the first. (A similar turn may be made lower on the dressing if necessary to anchor it.) On reaching the left temple the second time, the bandage is held by the thumb or finger of the left hand (a reverse may be made at the temple) and carried obliquely downward and upward to the first circular turns so as to include the lowest portion of the dressing. A complete circular turn is then made to anchor the preceding turn on the temple. These turns are repeated until the dressing is covered. Each oblique turn over the dressing should be higher than the preceding one, overlapping it one-half its width. The circular turns should exactly cover the preceding ones. The bandage is finished by one or two circular turns. The dressing should be completely covered and firmly secured when the bandage is finished.

In covering the dressing some surgeons apply alternate turns first over the lower portion, then the upper portion of the dressing, the last turn being made over the center of the dressing. The bandage is finished as before by circular turns.

Some surgeons also believe that the bandage may be applied with greater ease and security when the turns are made in the opposite direction to that first described: That is, in applying a dressing to the right ear, the initial end of the bandage is placed over the upper portion of the dressing and carried from right to left, making two circular turns to anchor the bandage. On reaching the occiput the second time the bandage is carried obliquely downward and upward to the right temple so that it covers and includes the lowest portion of the dressing. A reverse is made at the temple and a complete circular turn made to anchor the oblique turn. These turns are repeated until the dressing is covered, finishing with one or two circular turns. The oblique turns over the dressing may be alternately over the lower and over the upper portion of the dressing, the last turn being in the center if this method is preferred.

When the ear is well protected with the dressing and in its natural position the bandage may be carried from behind forward without causing the ear to be pushed forward.

Bandage to Both Ears.—This bandage is used to retain dressings on both ears, as after a double mastoidectomy. Before starting the bandage the dressing on one ear (say the right) is secured with a strip of adhesive extending from the forehead to the neck. Begin as in the above bandage. After making the oblique turn, which includes the lowest portion of the dressing on the left ear, and the circular turn which anchors it, carry the bandage from the occiput up, over the lowest portion of the dressing on the right ear, to the right temple. Reverse the bandage here if desired. Make a circular turn to anchor it and continue these turns until both dressings are completely covered.

Bandages of the Chest

Suspensory Bandage of the Breast.—This bandage is used to retain dressings on the breast, to afford support, and sometimes to apply pressure. A bandage two and a half inches wide and six to seven yards long will be required.

Before applying the bandage the usual care is given the skin. The breast must be properly protected with dressing, and cotton should be packed beneath the breast to support it. The shoulder should also be padded.

To apply the bandage, place the initial extremity under the breast to be bandaged. To anchor the bandage make two circular turns around the chest. If the left breast is being bandaged carry the bandage from left to right. If the right breast is being bandaged carry the bandage from right to left. On arriving below the breast, carry the bandage diagonally across the chest over the lower portion of the breast to the tip of the opposite shoulder. Then bring it across the back, under the arm of the affected side, under the breast, so as to cross the preceding turn, and directly around the body. On reaching the breast, the bandage is again carried over the opposite shoulder and again back to the breast. Each turn should overlap the preceding turn one-half to two-thirds its width. The alternate turns over the shoulder and around the body should cross each other in an even line and directly below the most pendant portion of the breast. These turns are continued until the breast is covered. Each turn on the shoulder may cover more of the preceding turn than over the breast, in order not to encroach on the neck. If necessary it may be turned in at the neck.

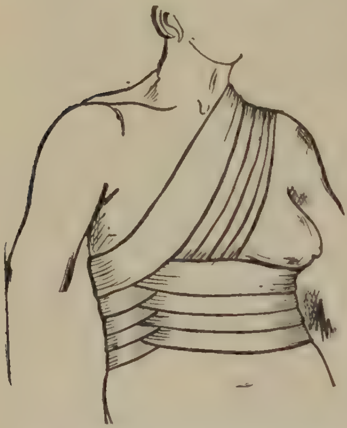
Fig. 93.—Suspensory Bandage of the Breast.

This bandage can be made more secure and will give better support if the following turns are added. Beginning under the affected breast two circular turns are made around the chest as before. On arriving below the affected breast the bandage is carried over the lower portion of the breast to the tip of the opposite shoulder. It is then carried across the back, but instead of carrying it under the breast as before, it is carried through the axilla, over the upper portion of the breast, down between the breasts, under the unaffected breast and around the chest to below the affected breast. A complete circular turn is then made. These turns are repeated until the breast is covered and properly supported. It is not necessary to make the complete circular turn alternating each time with the oblique turns given; an occasional turn only is required.

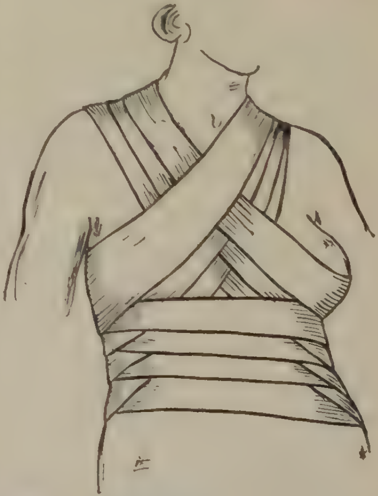
Fig. 94.—Suspensory Bandage of Both Breasts.

Suspensory Bandage of Both Breasts.—Two roller bandages each six yards long will be required. Place the initial extremity of the bandage under the right breast and anchor it by two circular turns around the chest. On arriving below the right breast carry the bandage under the lower portion of the breast over the tip of the left shoulder, across the back and around the chest underneath the left breast, obliquely across the back to the tip of the right shoulder. It is then brought obliquely across the anterior chest beneath the left breast and around the body to beneath the right breast. These turns are repeated until both breasts are covered, each turn overlapping one-half to two-thirds the preceding one and the crosses being made in an even vertical line and below the most pendant portion of the breast.

This bandage may also be made much firmer by adding the extra turns as described in the bandage of one breast. The two circular turns are made around the chest as before. On arriving below the right breast the bandage is carried over its lower portion to the left shoulder, then across the back, across the anterior chest underneath the left breast, obliquely across the back to the tip of the right shoulder, obliquely across the anterior chest below the lower portion of the left breast, then across the back, through the right axilla and over the upper portion of the right breast. It is then carried below the left breast, across the back and around the chest to beneath the right breast. From this point it is carried obliquely upward over the upper portion of the left breast, through the left axilla and downward to the circular turns around the chest. The bandage is then carried around the chest to beneath the right breast and obliquely upward to the left shoulder. These turns are repeated until both breasts are covered. The bandage is completed by one or two circular turns around the chest.

PLASTER BANDAGES

Plaster Bandages.—These bandages are made by rolling or rubbing plaster-of-Paris into the meshes of crinoline. As explained previously they are used to immobilize joints and sometimes to afford support in diseases of bones or joints.

When applied the bandage forms a cast. It may be a circular cast—that is, completely encircle the limb,—or a molded cast which fits the limb but does not completely cover it. The molded cast is bandaged in place with a gauze bandage. It supports and immobilizes the part and allows for frequent inspection. It does not interfere with the circulation and the nutrition of the part as the circular cast, if not properly applied, is in danger of doing. It is more convenient when a dressing to the part is required. In the circular cast a hole is made over the wound by means of which dressings may be changed.

To Make Plaster-of-Paris Bandages.—The crinoline is first cut into strips of the desired width and length and rolled into roller bandages. A large flat surface will be necessary upon which to make the bandages. The table and floor should be protected. The required amount of plaster is placed on the table. The plaster should be fresh, free from lumps, and of a good quality which will dry quickly. The crinoline bandage is placed on the table opposite the operator, with the body uppermost and the initial end drawn toward the operator. The plaster is spread over the crinoline freely and is rubbed smoothly and evenly into all its meshes. A spatula may be used for this purpose but the best method is to rub it in with the ball of the palm of the hand (the eminence made by the base of the thumb and other metacarpal bones). This forms a sensitive roller by which the plaster may be rubbed in and the smoothness and evenness of the result more accurately gauged than when using a spatula. A rubber glove may be worn if desired. The strip is loosely rolled as each portion is finished. The plaster bandages when finished should be kept in an air-tight box.

To Apply Plaster-of-Paris Bandages.—The bandages are usually applied by the surgeon. The nurse assists by preparing the patient and the articles required, and assisting with the application.

The part to be bandaged is shaved, washed, dried thoroughly and powdered. The bed and the floor should be protected. A rest should be provided to elevate and support the part which must be kept in the proper position, that is, the position in which it is to remain after the application is completed.

The articles required will be rubber gloves and a gown for the doctor, plaster bandages, the number depending upon the part bandaged and the desired strength of the cast, canton flannel or sheet wadding bandages, which are first applied to protect the skin, and a deep basin with sufficient warm water to completely cover three or four bandages at a time if necessary. Salt, one dram to a quart, is sometimes added to the water to hasten the drying of the plaster. Two or three sandbags may be required to steady the limb. Some surgeons require a basin of dry plaster, which they rub over the bandages after they are applied. This is moistened with water and spread over the whole surface, giving it a smooth, even, and finished appearance.

In applying the plaster bandages, a portion of the canton flannel or sheet wadding is left uncovered so that it can be turned back in the form of a cuff over the rough edges of the plaster in order to protect the skin.

After the bandage is completed the part must be left undisturbed and kept in exactly the same position until the cast is dry. Sandbags are placed at either side to prevent movement. The cast is left uncovered until dry. The bedclothing should be arranged to keep the rest of the body warm and comfortable. A cradle is sometimes placed over the cast, and an electric light suspended from it to supply heat to hasten the drying of the plaster. The bedclothing may be draped over the cradle.

It is important to remember that the plaster in the basin should never be thrown down the hopper or closet because the plaster as it hardens would block the pipes.

Nursing Care.—Extensive plaster casts, particularly those confining the body, are often a source of great discomfort to the patient. The most constant attention and careful nursing will be required to lessen the discomfort and to keep the skin in good condition. The skin around and under the edges of the cast will require constant watching and care to prevent irritation, chafing, and pressure sores. Plaster casts are never applied as tightly as other bandages because they shrink as they become dry. The parts below the cast should be watched for symptoms of disturbance in the circulation such as pain, pallor, a bluish color, tingling or numbness.

It must also be remembered that the patient's mental attitude and general health have a marked influence on the healing of the injured or diseased bone.

Removal of a Plaster Bandage.—The cast is first moistened in a straight line where the opening is to be made. A solution of sugar and water, peroxid of hydrogen, vinegar, or bichlorid of mercury are solutions used for this purpose. The cast is then cut with a plaster knife, saw, or scissors.

ADHESIVE STRAPPING

Adhesive plaster is used extensively in surgery to hold dressings and splints in place, to afford support and uniform pressure and to immobilize the part so as to secure rest and freedom from pain in diseases of the joints and in strains, sprains or fractures. It is applied most frequently to the chest, back, knee, ankle, wrist or elbow joint.

Adhesive plaster is made of rubber, petroleum and either lead acetate or zinc oxide spread on linen. It is applied directly to the skin. The warmth of the body is usually sufficient to make it adhere; if not, the adhesive may first be flamed over a lamp.

Before applying plaster to the skin, the part must be clean and dry and, if necessary, shaved to avoid irritation and pain on removal. The part to which the strapping is applied must first be placed in the proper position and maintained in this position throughout the procedure. The strips must be applied so that the pressure and support will be supplied where needed the most. The success of the application will depend upon this. In applying plaster care must be taken to make it fit the surface smoothly, without wrinkles; snipping the margin at intervals will help to accomplish this result. If necessary to apply adhesive over bony prominences, such parts should be protected. It should never be applied tightly enough over fleshy parts to cause its edges to cut into the tissue. When ascending strips are applied to a fleshy part gradually increasing in circumference care must be taken to avoid too much traction on the upper edge of the strap. Adhesive should be removed when soiled, curling or peeling at the edges. Adherent portions should be removed with benzine or ether. After the removal of adhesive the part should be washed with soap and warm water, dried thoroughly and powdered with talcum powder.

Strapping the Chest.—Strapping is applied in fractures of the ribs and in dry pleurisy to limit the motion of the chest during respiration. In fractures this is necessary in order to relieve pain and to promote healing by keeping the part at rest and the edges of the broken bone together. Constant motion would continually break down the bridge of new tissue formed by Nature to knit the bones together. In pleurisy it is necessary in order to relieve pain and prevent further irritation resulting during inspiration from the friction or rubbing together of the inflamed membrane or pleura covering the lung and that lining the chest wall.

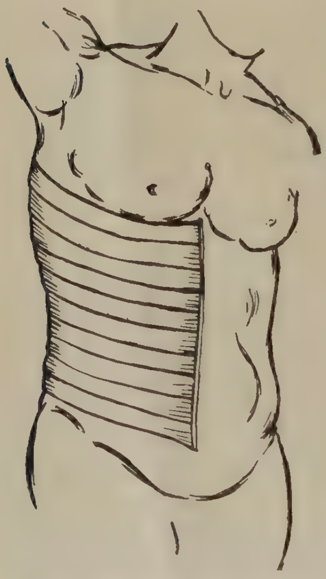
FIG. 95.—STRAPPING THE CHEST.

To strap the chest take strips of adhesive two or two and a half inches wide and long enough to extend from the middle line of the vertebræ to beyond the median line of the sternum. In applying the straps, one end is fastened on the spine and the patient is asked to take a deep breath. During the act of expiration, when the lungs are comparatively empty, the strap is quickly stretched around the body at right angles to the spine (not in the direction of the ribs) and fastened tightly over the sternum. The first strap is applied below the margin of the ribs. The second and following straps are applied in the same way from below upwards to just below the breasts. Each strip overlaps about one-third of the previous strip. A narrow strip of adhesive is applied to cover the ends of the strips over the sternum and the spine to prevent the ends from curling.

To Strap the Back.—Strapping with adhesive plaster is frequently used in the treatment of a strain or sprain of the back. When the muscles or ligaments of a part are strained, every movement of that part causes severe pain. The purpose of the strapping is to limit the motion and relieve pain. The straps may be applied as shown in Figure 96. The area covered will depend upon the location and extent of the strain.

To Strap the Knee.—Strapping is frequently used to give support and to immobilize a sprained knee. The strips of adhesive should be one inch wide and should be long enough to extend around the leg and joint and cross each other in front in the median line. Crossing the strips gives increased support. Each strip should cover one-half the preceding one. In applying the strapping, the first strip is placed behind the thickest portion of the calf and is carried obliquely upward around the leg and crossed in front as shown in Figure 97.

To Strap the Ankle—Strapping is applied to the ankle to support and immobilize a sprained ankle. Before applying the strapping the foot is supported and placed in the proper position, that is, flexion and inversion of the ankle. The patient may hold the ends of a bandage which encircles the ball of the foot in order to maintain this position during the application.

The strapping consists of vertical straps which extend under the foot and up over the ankle and leg on either side. These alternate with horizontal straps which extend around the heel and back of the leg and over the ankle and foot on either side. The width of the straps used is usually one inch. The length of the horizontal straps may be from twelve to fifteen inches or more, depending upon the length of the foot. The length of the vertical straps depends upon the extent of the sprain and the portion of the limb necessary to immobilize. About twenty-four inches may be necessary.

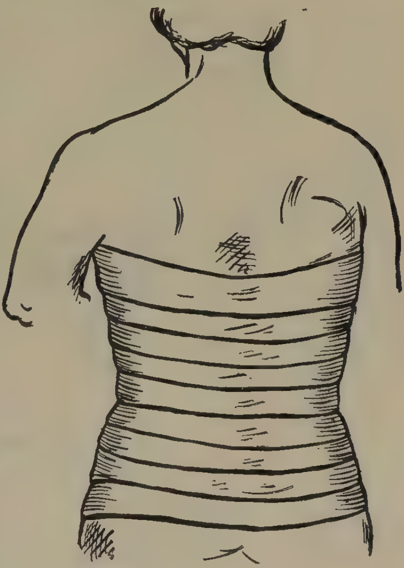

Fig. 96.—Strapping the Back.

The method of applying the strapping is determined by the anatomical formation of the ankle joint as the purpose of the application is to immobilize this joint. It is a hinge joint, the chief motion being upward flexion, and extension. It is formed by the astragalus (the second tarsal bone) and the external and internal malleoli (commonly called the ankle-bones) which clasp the astragalus on either side. The strength of the ankle joint is due largely to the lateral ligaments attached to these bones and to the many closely associated tendons. In sprains of the ankle it is usually these tendons and ligaments which are trained or lacerated. In strapping the ankle, therefore, the attention should be directed to affording support and limiting the motion about the heel and malleoli.

The center of the first vertical strap should be placed under the foot so that when applied to the leg it will pass directly over the external and internal malleoli on either side. The center of the first horizontal strap should then be placed behind the ankle so that when applied it will pass directly over the malleoli on either side. The horizontal straps should be made to cross on the instep; this gives added support and helps to immobilize the joint. The vertical straps must be applied with downward pressure on the outside of the foot and firm upward pressure on the inside or arch of the foot. The vertical turns applied alternate with the horizontal straps in each case crossing each other in an even line working toward the heel. Each strap overlaps one-third or one-half the preceding one. The straps are continued until in each case the tip of the heel is reached. Horizontal straps may also be applied higher up around the ankle, depending upon the degree of immobilization desired.

The center of a vertical strap should then be placed beneath the sole of the foot near the center of the arch and firm traction made on the upward turn on the inside or arch of the foot to further strengthen the support. Several horizontal straps should also be applied over, above, and below the malleoli to further limit motion. The last strip should be applied directly over the tip of the heel, so that it is completely covered, and carried upward with firm traction so as to cross in front of the ankle. A short strip should cover the ends of the vertical strips to keep them from curling.

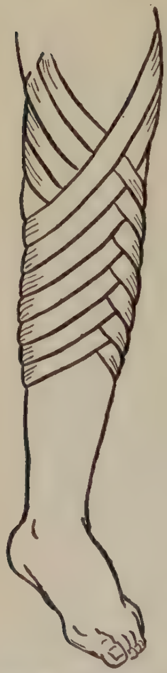

Fig. 97.—Strapping the Knee.

The Bradford Frame

The Bradford frame is used to restrain children in the treatment of fractures and diseases of the spine, hip and other joints. It may be used for restraint after operations, to relieve pressure on bedsores or wounds of the back and to protect dressings on the back or thighs from soiling by the involuntary passage of urine or stools.

The frames are made of gas piping and vary in length and width according to the child. They should always be about a foot longer than the child and wide enough to avoid contact with the shoulders. Two pieces of canvas are stretched across the frame and stitched securely to it. A space is left between the upper and lower strip wide enough to leave the buttocks free and allow the use of the bedpan. The frame and canvas are covered with a sheet. The child is placed on the canvas with the buttocks directly over the space. Strips of canvas or other stout material are fastened to either side of the frame and are laced over the body of the child, holding him securely to the frame. The length of the strips varies with the case and the restraint required. They may extend from the axilla to the ankle or from the axilla to below the crest of the ilium with separate strips to restrain one or both legs. A cotton ring should be placed under the heel of the restrained limb to prevent pressure sores. The frame may be fastened to the sides of the bed. When used to prevent soiling of dressings from urine, etc., the frame is suspended from the sides of the crib and the bedpan is left on the bed under the buttocks. The lower canvas should be protected by a rubber. When used to prevent pressure the frame is suspended and the canvas adjusted so as to leave the wound or tender spot free from contact with the canvas or bed. The mattress of the bed may be covered with a rubber sheet or spread. The child is covered with the usual bedclothes.

Sandbags of different sizes are used extensively for restraint or support in maintaining certain positions. They are also used to limit motion and relieve pain due to the twitching of muscles. They are sometimes covered with stout ticking but are more satisfactory when covered with rubber as they are easily cleansed and disinfected. When covered with ticking, washable covers must be provided. An extremity or other part of the body may be restrained by covering it with a towel and placing sandbags over the ends of the towel and fitted snugly against both sides of the limb. This will prevent both lateral and upward movement.

CHAPTER XVIII

ELEMENTARY NURSING IN SURGICAL DISEASES

THE CARE OF THE MILDLY OR CHRONICALLY ILL AND CONVALESCENT PATIENT

Pre-Operative and Post-Operative Care

Opportunities for Serving and Learning.—Students are given experience in the care of patients in surgical wards because of the special knowledge, special skill, special attitudes of mind, appreciations, and qualities of character which are essential in nursing and which can best be learned and developed here.

In surgical diseases, in addition to the care of the convalescent, the chronically and acutely ill patient, nursing includes the preparation for and the care of patients following an operation. In a surgical ward, each day patients are prepared for operation and taken to the operating room usually accompanied by a student nurse. While in the operating room preparations are made in the ward for her return. An operation is a crisis in the life of a patient. She needs the support and confidence which come from expert care before the operation and usually the expert care required by the acutely ill following the operation. Frequently the assistance of a second nurse is desirable, although sometimes the patient's condition is such that she requires only continuous observation, taking the pulse and respiration, care if nauseated or vomiting, nursing measures to insure comfort, and words of reassurance with returning consciousness. There is much that a young student nurse, properly instructed, may do to assist and so, by observation and supervised practice, may learn, without full responsibility, the care of such patients as a preparation for future responsibility for their complete care.

When the patient's condition permits, the responsibility of the general preparation, of taking the patient to the operating room, of preparing for her return, of caring for her on the way back to the ward and while under the influence of the anesthetic—these important duties are frequently assigned to a young student nurse under the supervision of an older nurse.

She may also assist this nurse in the care of the seriously ill. The responsibility of preparing the immediate area for operation will be assigned to a more experienced nurse, so will be discussed later.

Both before and after an operation it is extremely important to keep up the patient's strength so as to withstand the shock of the operation and provide for tissue repair.

The nursing care discussed in the present chapter and the fundamentals discussed in previous chapters are the most important factors in securing comfort and a prompt, satisfactory recovery. Skill and knowledge are both essential.

THE GENERAL PREPARATION OF THE PATIENT

Examination by the Surgeon.—To avoid fatigue on the day of the operation, the patient is usually admitted to the hospital a day, or sometimes several days previous to that assigned for the operation. Every patient who enters the hospital is given a very thorough physical examination which must be completed, if possible, before the day of the operation in order to have the reports, without which the surgeon will not operate, and in order to avoid excitement and fatigue on the day of the operation.

Before risking an operation or a general anesthetic, particular attention is given to an examination of the heart, blood vessels, and blood, the lungs, and the urine. Certain *diseases of the heart* and *blood vessels* may contra-indicate the risk of operating or of giving a general anesthetic, or at least indicate the need for very great care: An *examination of the blood* may indicate that the patient is a "bleeder," that is, that he has a tendency to bleed easily and may even bleed to death from a very slight injury: An *examination of the lungs* may show a disease of the lungs such as tuberculosis or acute bronchitis, either of which would contra-indicate the use of ether anesthesia: An *examination of the urine* may show that the patient is suffering from nephritis (inflammation of the kidneys), or from a disease of metabolism such as diabetes, both of which conditions contra-indicate the administration of a general anesthesia.

All such examinations and all matters relating to the patient's preparation should be attended to promptly so that the patient from the moment of entrance will have a feeling of assurance that his affairs are receiving individual, personal attention.

These conditions will be discussed in a later chapter but it is necessary that every student in the ward should understand the importance of this preliminary examination.

The Mental Preparation.—Many of us have had, or at least can imagine, the harrowing experience of undergoing or of anticipating, with more or less fear and trembling, such an ordeal as an operation. Perhaps it is even more harrowing to anticipate this ordeal for one that we love. A surgical operation is almost always considered a tragedy involving as it does both mental and physical suffering. We have, then, only to put ourselves in the position of the patient or the relative to guide us in our care. Patients dread various phases of the ordeal—many dread the thought of being physically hurt; many dread the anesthetic—the discomfort of "going under," the loss of consciousness, the discomfort following, the fear of saying or doing foolish things;

some anticipate and fear death; many say they would not mind the pain and discomfort following "if it were only over."

All these factors have a very depressing effect on the nervous system and play a very pernicious rôle in contributing to the shock accompanying an operation. So important is this that, in some cases, the patient is guarded from even the thought of the possibility of an operation and in other cases morphine is given to quiet and soothe the whole nervous system. Precaution is now also taken not to tire the patient out by the preliminary preparation, to insure a good night's rest and, if possible, to perform the operation early in the morning before the patient can work himself into a state of anxiety. While fatigue is to be avoided, it is well to keep the patient's mind occupied. Simple exercises are frequently recommended before and after an operation when the patient's condition permits.

The nurse by every look, word and action must try to reassure the patient. Encourage and strengthen his confidence in his surgeon, in the nurses, in their unquestioned ability to meet every situation, in the hospital, and in the adequate provision made for his proper care and recovery.

While time is valuable, there must be no excitement or undue haste, no divided attention and an impression given of having too much to do.

Another factor contributing to shock is the loss of body heat. The depression caused by fear lessens the heat production in the body so care must be taken to keep the patient warm before leaving the ward, on the way to and from the operating room, and during the recovery.

The patient's relatives must also be considered. In all cases they are notified of the approaching operation and if the patient is under age, permission in writing is usually required by the hospital. When the patient desires to see a relative it is usually permitted for a few moments. Every consideration must be shown for the natural anxiety of relatives or friends who sometimes suffer more acutely, in anticipation of the danger, than the patient himself.

The Physical Preparation.—Freedom from discomfort following an operation depends to a large extent upon the patient's previous condition and preparation. A body well nourished, free from fatigue, and not depleted by disease, fasting, or too free purging will have less discomfort, will react better, and more quickly assume its normal functions.

Orders for the preparation are left by the doctor but a surgeon usually adopts a routine preparation which the headnurse follows unless other orders are given. The care outlined in the following is the routine frequently followed:

The Alimentary Tract.—On the day previous to the operation, the patient is usually allowed three meals as usual which, however, should be light and nourishing. No food usually is given after the evening meal.

Some doctors, however, allow food up to within a few hours of the operation, such as a light breakfast of toast and tea without milk or butter, if there is no mechanical obstruction. (The stomach normally empties in from four to six hours and should be completely empty after a lapse of seven hours.)

He is encouraged to drink extra water, sometimes for two or three days before the operation and by some surgeons and in some conditions up to within two hours, sometimes within half an hour, of the time scheduled for the operation.

The Stomach.—It is most important that the stomach should be empty before operating for several reasons:

1. During the second stage of ether anesthesia the patient usually coughs, chokes and may vomit, so that there would be great danger of particles of food being drawn into the lungs and either choking the patient or later setting up pneumonia. The saliva and secretions from the throat always contain bacteria.

2. Again, after the operation vomiting may occur (from the irritating effect of the ether) and food particles may be drawn into the larynx and lungs. Bacteria may be carried in with it and later cause a septic pneumonia. When the patient is under the influence of the anesthetic the reflexes in the larynx and bronchi are lost so that food, blood, mucus, etc., are not expelled or coughed up as usual.

3. The patient will continue to suffer from nausea and vomiting following the operation. This is extremely distressing, causes great pain, and strain on the sutures, tires the patient out, and prevents him from retaining any nourishment.

The Tissues.—When we stop to think that a large percentage (about 90 per cent.) of protoplasm, or about 60 per cent. of the body, consists of water we can understand how depriving the tissues of water will interfere with their function and may even cause death of cells.

Thirst is, therefore, one of the most distressing discomforts from which patients suffer following an operation. This is particularly true if fluids have been limited before or if considerable blood has been lost during the operation, or, it may be due to the free perspiration following and the limited amount of fluids the patient is able to take and retain after the operation. To avoid this fluids are often encouraged before the operation.

The Intestines.—The intestines should be free of fecal matter for the following reasons:

1. The general anesthetic given is to render the patient unconscious and free from pain due to the operation and also to relax all the muscles of the body. This means that control by the will of the patient of the sphincter muscles, which normally guard the passage of feces from the rectum and urine from the bladder, is lost so that the contents of the rectum or bladder may be expelled on the operating table. This is a most distressing and embarrassing situation. It also renders unsterile the draping of the patient which must therefore be changed. This results in a

serious delay when the life of the patient may depend upon the speed with which the operation is performed.

2. The accumulation of contents in the intestines prolongs nausea and vomiting after an operation. This accumulation also predisposes to fermentation of the contents with gas formation resulting in distention of the intestines. This causes great discomfort and may prove very serious for it pushes the diaphragm up and interferes with the action of vital organs, the heart and lungs.

3. A stomach or intestine distended with food may accidentally be injured during an abdominal operation. To prevent the above conditions a cleansing enema is given to free the lower bowel of its contents. If the result from one enema is not satisfactory, sometimes two or more enemata, or a colon irrigation, may be ordered. Sometimes, particularly for operations on the vagina, rectum or perineum, enemata are given until the return is clear, showing a thorough cleansing. The cleansing enema is always given six hours before an operation in order to give the peristaltic unrest time to subside. When the operation is an emergency, unless four hours will elapse, the enema is usually omitted.

Sometimes a cathartic is ordered on the previous day or evening to insure a thorough cleansing, but this practice has been discontinued by many surgeons for several reasons. Free catharsis depletes the patient's strength too severely, robs the tissues of water, relaxes and lowers the tone of the intestinal muscles so that they do not recover after the operation, thus predisposing to the dreaded distention.

The omission of the cathartic insures the patient a better night's rest and leaves the intestines in better condition to react to the paralyzing effect of the anesthetic.

Final Preparation.—The patient must be scrupulously clean, her hair clean and neatly braided in two plaits, and sometimes confined by a cap or towel before leaving the ward. There should be no combs or pins left in the hair as they might injure the scalp. To avoid fatigue and hurry on the morning of the operation the cleansing bath is usually given on the previous day. False teeth or a plate must be removed. When the muscles are relaxed these may fall and interfere with breathing or a single tooth may be accidentally broken and swallowed or enter the larynx. No jewelry, which might be lost or damaged, is allowed to be worn. All such valuables—teeth, money, jewelry, etc., should be parceled, labeled, and given in charge of the head-nurse.

The clothing consists of a clean gown, loose around the neck, long flannel stockings (laparotomy stockings) securely and neatly fastened, and a diaper to avoid exposure. In cool weather a chest protector is worn under the gown.

The temperature, pulse, and respiration are always taken and recorded on the chart. All reports (of urine and blood examinae tion, etc.), all treatments and medications given are charted, also the time at which the patient leaves the ward for the operating room. The chart accompanies the patient.

Shortly before (5-15 minutes) the patient leaves the ward, the bladder must be emptied both to avoid elimination on the table and an accidental puncture of a distended bladder in an abdominal operation. Occasionally, in operations on the pelvic viscera, the bladder is catheterized to insure a complete removal of urine. A cleansing vaginal douche is also given as a preparation for operations on the pelvic organs.

When leaving the ward for the operating room the patient is placed gently on a stretcher, or in a wheel chair, and warmly covered with blankets. A patient is usually not allowed to walk to the operating room. Some surgeons, however, believe that when the patient's condition permits that it is better to allow them to occupy themselves in their normal manner—to read, to go about and talk with other patients, and to walk to the operating room. Their time and attention are then fully occupied and their mind is not apt to dwell upon the coming ordeal. The mild exercise is also beneficial in keeping up the neuromuscular tone.

A nurse always accompanies the patient. He should be taken to the waiting room or the anesthetizing room and under no conditions should he be allowed to see or hear what is going on in the adjoining operating room. The nurse, before taking the patient into the anesthetizing room, should see that the doors leading to the operating room are closed and should shield her patient from the sight or sound of anything which might be alarming. His mind should be diverted if possible and he must never be left alone until in charge of another nurse. Nurses should carefully avoid all professional talk which could in any way be disturbing to the patient. Place yourself or your mother in the position of the patient. The influence of suggestion is always a very powerful factor but especially so before one loses consciousness, as in sleep or anesthesia, or just before one awakens. Its influence for good or evil lasts throughout, as illustrated in "good" or "bad" dreams, and has marked effect on rest, sleep, and comfort following an operation. The anesthetist, therefore, talks reassuringly to the patient while he is "going under" the anesthesia, likewise the nurse when he is beginning to become conscious.

Preparation in the Ward for the Return of the Patient.—The preparation must provide for a patient who is unconscious, who will be suffering more or less from shock, nausea and vomiting, who is coming from a very warm operating room, and who is apt to be extremely restless and noisy as the effects of the anesthetic wear off.

Effects of the Anesthetic.—An anesthetic depresses the whole nervous system and, therefore, not only causes unconsciousness, but depresses or checks the functions of every organ in the body.

It checks all the processes of oxidation in the body by which normally heat is produced—the digestive processes and the action of glands are checked and the muscles are all relaxed so do not produce any heat. External heat must, therefore, be provided to maintain the body temperature. The muscles of the heart and blood vessels may be so relaxed and the nerve centers in the brain which cause them to contract may be so depressed that the pulse becomes very weak. The circulation becomes very poor so that the blood stagnates in the large veins—this condition is called shock. Heat is one of the best stimulants to counteract shock. The muscles in the walls of the stomach and intestines will also be relaxed. The stomach may become dangerously dilated and the intestines may become distended with gas. The anesthetic also has a very irritating effect on all mucous membranes: Irritation of the lining of the stomach causes nausea, irritation of the lining of the respiratory tract predisposes to ether pneumonia, and irritation of the kidneys may check the secretion of urine. Pneumonia is particularly to be feared. The chilling of the lungs by the evaporation of ether, its irritating effects, the possible aspiration of the pneumococcus with saliva, the lowered resistance of the tissues due both to the anesthetic and the operation all predispose to this very serious complication. The anesthetic is eliminated from the body through all these channels and it may take several days before it is all eliminated so that the odor remains in the room and about the patient.

Effects of the Operation.—Many nerves will be cut or injured during the operation and this adds to the depression of the nervous system and the danger from shock. The exposure, etc., of the stomach, intestines, and bladder predisposes to loss of tone in the muscles, with later loss of function. The severing of many blood vessels may cause considerable loss of blood during the operation, but with modern methods of surgery this seldom occurs as the vessels are clamped and tied off immediately. Bleeding from the small vessels is checked by the clotting of the blood. Hemorrhage from these vessels may occur after the operation: As the heart becomes stronger and the circulation is improved, bleeding may again start from the small blood vessels or the ligatures or sutures used to tie off the larger vessels may slip due to the restless movements of the patient or other causes. These restless movements of the patient may also cause the tearing open of the wound. Every movement of the patient will also cause pain for the wound means injury to nerves, and cutting through muscular tissue so that the contraction of those muscles pulls open the wound and causes great pain. This may be prevented by a position which will allow relaxation of the muscles.

To avoid the effects of the anesthetic, and of the operation, and the discomfort and complications which may follow, the preparation for, and care of the patient should be as follows:

The **room**, when possible, should be quiet, with the light shaded, warm (70°-80°) but with plenty of fresh air. The bed should not be in a draft. If in a public ward, as far as possible, the patient should be isolated for the first twenty-four hours, either in a small room or by placing screens around the bed in order to secure quiet and privacy for the patient, also in consideration of the other patients.

The Bed.—A specially prepared bed, called an ether bed, is made. There are several varieties used, but in all the essential points observed are as follows:

The bed must be stripped and the mattress turned because it will be some time before this can again be done. When possible the linen should be fresh throughout, but the nurse must use judgment and common sense in this in order to avoid overtaxing the laundry. While the bed must be fresh and clean, it is not necessary to change linen because creased. Extra rubbers, especially at the head, are usually necessary to protect the bed as vomiting generally occurs. As the patient is returning from a very warm operating room and may be perspiring freely, and suffering more or less from shock, the bed must be well warmed and extra blankets provided to maintain the body heat and to prevent chilling, which predisposes to pneumonia. Heat is one of the best stimulants to counteract shock. Several hot-water bottles are placed in the bed to warm it, but are removed before the patient is put in bed. They are never left in the bed of an unconscious patient without a special order and when left in they must be outside the blanket, never next to the patient. The patient should not be left alone and when one nurse transfers the care of the patient to another nurse she notifies her of the number and location of the hot-water bags. (See use of hot-water bags, Chapter XVI.) When the patient is restless care must be taken to avoid the bags being displaced so that the patient may lie on one, and in all cases the skin must be watched closely. When the circulation is poor the skin burns very easily. The pillows are always removed (except for some head cases) and, as they will not be used for several hours, should be returned to the proper store closet. With the head low the patient suffers less from nausea and from shock. When shock is feared, the head is still further lowered by elevating the foot of the bed with "shock blocks" or other means. These should be in readiness for use. This is in order to increase the blood supply in the brain and stimulate the vital centers. A rubber covered with a towel is used in place of the pillow. As the patient is always restless one hard flat pillow is usually stood upright against the head of the bed to prevent injury. The upper clothing may also be tucked in tightly at one side.

The bed must be made in such a way that the clothing may be quickly turned back, the patient lifted easily and smoothly in, and covered. An extra blanket should be ready in case of shock. An extra towel is usually placed at the head of the bed to place across the chest to protect the upper clothing from vomitus.

The table should be placed conveniently and not in the way when lifting the patient into bed. On it there should be a kidney basin (it is wise to have two basins) and a supply of cut gauze in case of vomiting. Sometimes a mouth gag and a tongue retractor are also placed on the table.

Bringing the Patient Back to the Ward.—The operating room usually notifies the ward when the patient is about ready to return and a nurse goes up to care for the patient in returning. She may probably have to assist in lifting the patient from the operating table to the stretcher.

Lifting to the Stretcher or to the Bed.—*Backache* is one of the most universal and distressing discomforts following an operation. This results from:

1. Careless lifting of the unconscious and relaxed patient from stretcher to operating table or from operating table to stretcher.
2. Lying on a hard operating table for several hours with the muscles in an extremely relaxed condition. When the muscles of the trunk are relaxed the strain is thrown on the intervertebral ligaments. To prevent this the table is now usually padded. An air cushion, or small pad or pillow which fits the small of the back, and a pad under the knees are used to prevent the back muscles from being too relaxed.
3. Lifting the patient by the small of the back to adjust abdominal binders, etc., or lifting or swinging the patient from the operating table to the stretcher or from the stretcher to the bed by means of a binder under the small of the back.

This all accentuates the strain on the intervertebral ligaments.

4. Lack of adequate assistance and careless lifting from the stretcher to the bed.

Patients should always be lifted gently, with the body kept in the horizontal position and placed in bed in a comfortable position. They should also be lifted carefully to avoid strain on the sutures of the wound, to avoid starting a hemorrhage, and to avoid the spread of infection in the abdominal cavity if present; for instance, after the removal of an abscessed appendix.

Care on the Way to the Ward.—The patient must be warmly covered and securely fastened to the stretcher before leaving the warm operating room. He should be brought as quickly as possible to the ward—every delay in cool corridors increases the danger of shock and pneumonia. Avoid jarring the patient in transit. The head must be kept low always; for instance, if it is necessary to carry the patient up a few steps he should be carried feet first. A nurse and an orderly always accompany the patient—the nurse walks at the head so that she can watch the patient's color, pulse, and breathing, and attend to his needs when vomiting, etc.: A basin should be in readiness. The stretcher is wheeled with the head of the patient first. As he is moved very quickly, the rapid movement creates a current of air in the opposite direction which would be directly in the patient's face and might interfere with his already embarrassed breathing. Again the most convenient position for lifting the patient into the bed without taking any extra steps or time is with the head of the stretcher at the foot of the bed—this can be most easily arranged by wheeling the stretcher with the head of the patient first. The nurse should watch the patient's color, pulse, and breathing closely. While the muscles are all relaxed, the tongue may fall back and obstruct the breathing. This can be prevented by placing the fingers or thumb at the angle of the lower jaw and pressing it forward. This raises the epiglottis and the base of the tongue from the postpharyngeal wall. Placing the head in the position shown in the accompanying illustration "draws the base of the tongue and hyoid bone far forward, this motion being at the same time imparted to the epiglottis, so that the latter stands upright and is separated from the posterior wall of the pharynx by an interval of about an inch. By tightly closing the jaws the antero-posterior space is still further increased." The passage to the larynx and trachea is thus kept wide open. The nurse's hand should be kept in position in readiness, but actual pressure should only be made when the patient's color or breathing indicates its need—constant pressure or unnecessarily firm pressure will cause the patient's jaw to be very sore later.

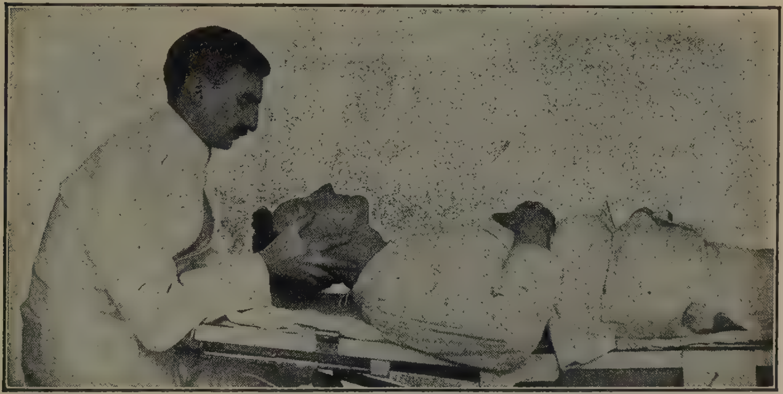

FIG. 98.—SHOWING THE ATTITUDE IN WHICH THE HEAD SHOULD BE HELD TO PERMIT THE EASY PASSAGE OF AIR THROUGH THE GLOTTIS. This position raises the epiglottis and lifts the soft palate from the tongue. (Martin and Hare's method.) (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

An ether anesthesia also causes increased secretions of the mucous membranes in the mouth, throat, bronchial tubes, and stomach. Excretions from the mouth and throat must be removed to prevent them from being swallowed or from being aspirated into the trachea and lungs, and either strangling the patient or later setting up an "aspiration pneumonia." Increased secretions in the stomach cause nausea and vomiting. The head should always be turned to one side (unless the nature of the operation forbids) so that the secretions and, if vomiting occurs, the vomitus will flow easily from the mouth and not be drawn into the trachea; keeping the head low also prevents this. The nerve endings in the larynx, trachea, and bronchi which normally, when irritated by a foreign body, cause the muscles of the larynx, etc., to contract and prevent its entrance into the lungs, are deadened by the anesthetic, and the muscles themselves are paralyzed so vomitus and secretions may easily enter. This may cause asphyxia or later "aspiration pneumonia." With the head on one side, also, the tongue is not so likely to fall back. Occasionally it may be necessary to grasp the tongue and pull it forward—this can only be done with the fingers, first wrapping a piece of gauze around them.

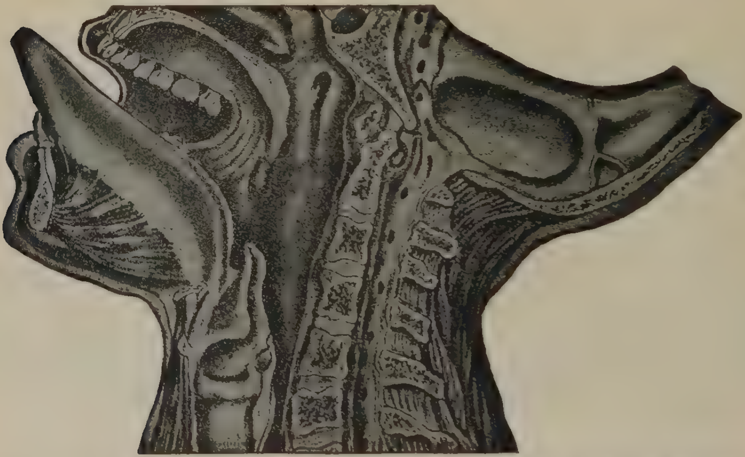

FIG. 99.—ILLUSTRATING HOW UPWARD TRACTION ON THE TIP OF THE TONGUE DRAWS THE EPIGLOTTIS AWAY FROM THE GLOTTIS OPENING AND PERMITS FREE INGRESS OF AIR. It also shows how letting the tongue fall back in the mouth in anesthesia would close the air-passages and permit the epiglottis to interfere with breathing. (From a Research by Dr. Martin and Dr. Hare.) (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

After-care in the Ward.—First remove the hot-water bottles. Place the head of the stretcher toward the foot of the bed so that the patient can be lifted quickly, without loss of time or energy, into the bed. Lift the patient gently and place him in a comfortable position in the center of the bed. Tuck the clothes in all around the bed. Put the screen around the bed. When possible have the room darkened, quiet, and warm, but with plenty of fresh air. Avoid drafts. In any case there should be no visitors, no talking, whispering, or commotion. Turn the patient's head to one side and cover the chest with a towel to protect the bed. When putting the patient to bed, or later, if the gown is dampened by perspiration or vomitus, it should be changed immediately for a warm gown in order to avoid chilling and the danger of developing pneumonia.

Chart the time the patient returns to the ward and his condition on return. Take his pulse and respiration and chart it. The pulse is the best indication of the patient's condition.

A nurse must watch the patient closely while unconscious because of the danger from vomiting or restlessness with resulting strain on the stitches, and the danger from hemorrhage or shock. The pulse must be taken frequently and any change to a weak, rapid, compressible pulse must be reported immediately. The pulse will increase in rate due to restlessness or vomiting, but this is only temporary.

As the patient begins to regain consciousness he may feel discomfort from the stockings, and extra blankets, etc. If the skin is warm these may gradually be removed, but care must be taken to avoid chilling the patient. He should be kept warm but not uncomfortably so, and profuse perspiration must not be encouraged, as it is very weakening and eliminates body heat and fluid of which the tissues are in need—this adds to the discomfort of thirst. In summer particularly, with high atmospheric temperature, a high percentage of humidity, and little breeze, care must be taken not to *overheat* the patient. This may cause "heat stroke," the symptoms of which are a very high body temperature (105°-109° F.), a rapid pulse, skin hot and dry, an ashen hue and anxious expression; or, it may cause "heat prostration," the symptoms of which are a subnormal temperature, a small, rapid, soft pulse, shallow, difficult breathing, and a cold, clammy skin. When the perspiration is profuse, cold and clammy, it is always a sign of shock. With profuse perspiration there is also much more danger of chilling the patient.

Every means should be taken to make the patient comfortable, for quiet, rest and sleep are very important for the first few hours. Cover the eyes with a damp compress. The patient will usually go off to sleep again if made comfortable and if quietly reassured by the nurse that the operation is over and that everything is quite satisfactory. Do not restrain minor movements as it only increases the restlessness and makes him more excited. Restlessness is usually due to anxiety as to the outcome of the operation or to some discomfort: Reassure the patient, change his position, arrange pillows, clean lips and mouth, etc., and tell him to go to sleep. Some patients are greatly reassured when they open their eyes and find some one near them and will go comfortably to sleep—others are embarrassed and prefer to be alone with some one within call.

When the stupor of the ether wears off the patient will suffer great pain and discomfort. Morphin is usually necessary to relieve the pain, but the surgeon avoids repeating this treatment if possible. Morphin keeps the patient quiet, gives him the necessary rest and freedom from pain, but it further paralyzes the intestines and predisposes to distention and obstruction. Rest and sleep, however, are essential. Good nursing will do much to relieve the pain and discomfort, and make this depressing and habit-forming drug unnecessary. Always watch the breathing after the morphin is given as it depresses the respiratory center and interferes with breathing.

Discomforts Following an Operation

1. Severe **headache** which is due to the effects of the anesthetic and an empty stomach. This may be *relieved* by applying a hot-water bag to the feet, and ice compresses to the forehead and an ice-cap to the top of the head; or, by gently rubbing menthol or aromatic spirits of ammonia on the forehead—this is both cooling and soothing. Headache may also be due to bad air, nervousness, fatigue, excitement, and visitors. Fresh air, rest, and absolute quiet are always necessary after an operation.

2. **Backache.**—The cause of backache has been explained. The best *treatment* is prophylactic; that is, avoid the cause. This discomfort is usually present, however, and may be relieved by: (a) Rubbing the back with alcohol. The limbs may also be rested by rubbing; (b) by elevating the head, placing a pad or small pillow in the small of the back and under the flexed knees. This position not only relieves the back muscles but relieves the abdominal muscles, lessens strain on the wound and pain. A Gatch bed is very desirable. The elevation of the head also prevents the later feeling of faintness when sitting up; (c) turning the patient on his side (when permitted), flexing the thighs and knees, and supporting the back, the abdomen, and knees with pillows—the pillows may be disposed to the comfort of the patient. Allow the patient to turn himself if he wishes as he can often do so with less discomfort. (d) The application of local heat; a thick, hot, flaxseed poultice, upon which the patient is allowed to lie, may be applied to the lumbar region (Dr. Brewer). Great care must be taken to avoid burning due to the heat of the body, the moisture of perspiration, and lack of provision for radiation or evaporation of heat. The patient may lie on his side while this or some other application of heat is applied.

3. **Thirst,** the **Odor of Ether,** and the disagreeable **Bitter Taste in the Mouth.**—Thirst may be due to limited fluids or to too free purging before the operation, to loss of blood during the operation, to vomiting, or to profuse perspiration following the operation, and the irritation of the ether anesthetic.

Treatment.—Unless contra-indicated, water may be given. If the patient has been vomiting it should be given in small amounts. Vichy, or Seltzer, or cold water may be used but hot drinks—water or weak tea—quench the thirst more quickly than cold drinks. Cracked ice is to be avoided as it intensifies the thirst. Some surgeons, however, allow cracked ice. When given it should be small enough to be swallowed as ice. Some surgeons only allow water after vomiting has ceased—the more they drink then the more quickly will the ether be eliminated from the whole system. Some surgeons allow as much water as the patient desires even before vomiting has ceased because it satisfies the patient, relieves thirst, aids the elimination of the ether, and, even when it increases the vomiting, it tends to act as a lavage and washes out the stomach so that irritating substances are more quickly removed. A lavage, or washing out the stomach, is the quickest and best way of relieving vomiting. It also helps to prevent distention of the intestines with gas, by removing the irritating ether and other toxic substances which cause loss of tone in the intestinal wall.

Thirst indicates that the tissues need fluid. To supply this fluid is now considered one of the most important factors in postoperative treatment. Fluids are now usually given freely by mouth, proctoclyses, subcutaneously, or intravenously.

Before giving anything by mouth, however, a nurse should find out the surgeon's instructions regarding each patient. Even when fluids are not allowed, the lips and tongue may be moistened frequently and the mouth washed with a refreshing mouth wash to counteract the bitter taste. The furred, dry tongue, and bitter taste are very trying to the patient.

Other methods of restoring water to the body will be discussed later.

The odor of ether about the room and the patient is very distressing to the patient and prolongs the feelings of nausea—frequently ever afterwards the odor of ether will cause nausea. Fresh air (avoiding drafts) will, therefore, be very refreshing and grateful to the patient. Be very careful to thoroughly cleanse the emesis basin when emptied and to change towels, etc., when charged with ether odors.

4. **Nausea and Vomiting.**—This very distressing discomfort invariably results from ether anesthesia but may also be due to the improper preparation of the stomach and bowel before operation, to the exposure and manipulation of the viscera during operation, or it may be due to pyloric or intestinal obstruction.

The irritation of the ether causes increased secretions in the stomach which results in nausea and vomiting. The vomitus usually consists of mucus and a greenish fluid containing regurgitated bile which gives the very bitter taste in the mouth: "As bitter as bile" is a common comparison made. When vomiting is due to intestinal obstruction, the vomitus will be dark brown in color and will have a fecal odor because it is material forced through the pylorus from the intestines due to antiperistalsis of the intestinal wall. This is a very grave symptom.

Treatment.—Where the patient is nauseated and vomiting turn the head to one side to allow free passage for the vomitus and to prevent it from entering the larynx. Keep the head low: Sometimes a small pillow may be allowed. During the act of vomiting, raise the head slightly and support it firmly. To avoid strain on the stitches, sometimes it is necessary to support the abdomen with the hands on either side the wound, but usually the tight abdominal bandage applied in the operating room is sufficient support.

Moisten the lips and cleanse the mouth frequently with a mouth wash or plain water. All secretions should be immediately removed from the nose or mouth. Remove all soiled articles from about the patient at once to lessen the danger of nausea. The soiled gauze pieces should be placed at once in a paper bag, the basin must be kept clean, and not allowed to stand on the table uncovered. Change the towels protecting the bed when soiled but use care to prevent the bed linen (especially the blankets) from being soiled so as not to necessitate disturbing the patient by changing the linen and to avoid ruining the blankets. Keep the bed neat and the patient as fresh as possible. Take great care to prevent the hair from being soiled.

Cracked ice sometimes relieves nausea but intensifies the thirst. Sips of very hot water or sips of ginger ale, champagne, or brandy (first poured over ice) sometimes give relief. When vomiting (or retching with no return) gives no relief, sometimes the patient is encouraged to drink water (usually warm water with a pinch of bicarbonate of soda). This induces vomiting and washes out the stomach. When vomiting continues, a hot local application or a mustard paste to the epigastrium often gives relief. An ice-bag over the epigastrium or a cold compress to the throat sometimes gives relief. Every body movement increases the vomiting so the patient should be kept very quiet, and no visitors or talking allowed. When vomiting continues longer than is usual (after twelve hours) complications (dilatation of the stomach or intestinal obstruction) are feared and other treatments are resorted to.

Washing out the stomach with water at 120° F. by means of a stomach tube usually stops the vomiting. (This treatment is called a lavage: It will be discussed in a later chapter.) The stomach is thoroughly cleansed and the heat causes a tonic contraction of the walls of the stomach which usually checks the symptoms. When nausea persists for two or three days and no complications are present, a change from a liquid to a very light solid diet often checks it at once.

5. **"Gas Pains"** or **Mild Abdominal Distention.**—These usually begin after the first twenty-four hours and cause great discomfort and pain. "Gas pains probably represent the beginning peristaltic movement of the intestines following the temporary cessation (functionally at least), due to the exposure and trauma necessitated by abdominal section. Unpleasant as they are to the patient, to the surgeon they are not of unfavorable significance because their presence usually means a reëstablishment of the normal motor activity of the intestinal tract which is causing pain because of accumulated gas throughout the tract." (Dr. Brewer.)

This distention of the intestines, called flatulence or, if marked, tympanites, may, however, become very severe and even dangerous because it prevents the descent of the diaphragm in breathing, pushes it up, and so greatly interferes with the action of the vital organs, the heart and lungs. It may also lead to intestinal obstruction, a condition which is always dreaded and is frequently fatal, because the muscular walls of the intestines may become so relaxed, weakened, and distended with gas that no treatment will cause them to contract and relieve the distention. The very first symptoms, the slightest tightening of an abdominal binder or adhesive strapping over an abdominal dressing, should be reported at once. When the patient is suffering from gas and vomiting it is particularly important to note the pulse and temperature, the character of which may greatly alter the significance of the former symptoms.

The distention is due to the loss of tone in the muscles of the intestinal wall caused by the ether (which relaxes all the muscles of the body), together with the exposure and trauma. The more quickly the ether is eliminated from the body the more quickly will the muscles recover.

Treatment.—The insertion of a *rectal* tube is often sufficient to start the expulsion of gas. *Position* has an important bearing on the accumulation of gas. It is more apt to collect when the patient lies flat on his back for some time. When permitted, turn him carefully on his side and flex his knees and thighs. This aids in the expulsion of gas. Flexing the thighs relaxes the abdominal muscles, relieves the strain on the stitches and injured tissues, and prevents pain. Pillows should be arranged to the comfort of the patient—to support the back, between the knees, and against the abdomen so that they support and offer *slight* pressure to the abdomen as the patient leans against them. The pressure helps to prevent the formation of gas and aids in its elimination, in the same way that little babies are relieved of pain by being turned on their face and allowed to lie on their stomach when suffering from pain due to gas in the stomach or intestines. *Elevating the head of the bed* so that the patient's head and trunk are elevated helps to prevent both vomiting and distention by favoring the onward peristalsis of the contents. *Changing the position* helps to prevent the accumulation of gas and aids in its expulsion. The patient must not be left in any one position too long. Changing the position also helps to prevent the formation of adhesions after an abdominal operation—adhesions consist of new connective tissue which unites two inflamed, irritated or raw surfaces of peritoneum together if they are allowed to remain in contact too long. Adhesions are formed by the peritoneum in the effort to wall off diseased tissue but they may later do considerable damage by interfering with the function of the intestines or other organs, and may necessitate another operation later to "break down" the adhesions.

The application of heat to the abdomen gives great relief: It stimulates the contraction of the intestinal muscles. It may be applied in the form of a hot flaxseed poultice or fomentations. At the same time a rectal tube is inserted in the rectum to allow the escape of the gas. *Stimulating enemata* and *colon irrigations* are given to remove the gas and irritating substances. *Drugs,* such as pituitrin, which stimulate the action of the muscles are also given. These treatments will be discussed in a later chapter.

6. Restlessness and Sleeplessness.—These conditions may be due to nervousness, to pain, or to discomfort, or to all combined. Morphin is usually necessary on the first night to relieve the pain and induce sleep but after that milder sedatives are usually used. The doctor and nurse may do much to relieve the nervousness by reassuring the patient and relieving his mind of all worry and anxiety. The first night's sleep is particularly important.

The nurse should see that all sources of discomfort are removed and that conditions are inducive to sleep. Changing the position, bathing the forehead and hands, rubbing the back and limbs with alcohol, rearranging the pillows, and preventing all disturbing outside elements such as worry, noise, light, visitors, and whispering, etc., all tend to quiet and calm the patient and induce sleep. Sleep is very necessary to conserve the patient's energy and aid him to react to the operation.

7. Retention of Urine.—One of the causes of discomfort and restlessness, sometimes, is failure of the bladder to expel the urine which has accumulated in it. This is because the muscles of the bladder are partially paralyzed by the anesthetic and for some time fail to regain their normal tone. If the patient fails to void within eight hours of an operation this should be reported to the headnurse. If one nurse is transferring the care of the patient to another nurse, she should report whether the patient has voided or not. It is the practice of some surgeons to catheterize the patient if he has not voided within twelve to fourteen hours, while other surgeons prefer to let Nature alone (unless the patient is in great discomfort), and will allow a much longer time to elapse (even 18 hours or more) in order to avoid the danger of cystitis.

In all cases following an operation, the urine must be measured and the amount charted for the first forty-eight hours. The first urine voided is always sent to the laboratory to be examined for abnormal constituents in order to find out if the anesthetic has had any injurious effect on the kidneys. If the examination or the small amount voided shows that the kidneys are damaged and are not functioning properly, all the urine voided for several days should be measured and charted, and usually it is sent to the laboratory for further examination. The urine is also measured for the first twenty-four to forty-eight hours following an operation because occasionally, in operations on the pelvic organs, failure to void may be due to the fact that a ureter has been accidentally injured or "tied off" by a ligature tied around the uterine artery to prevent hemorrhage, so that no urine can pass through that ureter. Such a condition is very serious and should be recognized and the surgeon notified at once.

Following operations on any of the urinary organs the urine voided is carefully measured, the amount charted, and the urine is daily sent to the laboratory to be examined.

The treatment for retention has already been discussed in Chapter XII.

Removal of the urine by catheterization will be discussed in a later chapter as this treatment is always performed by an experienced nurse.

While a young nurse will not be asked to nurse a critically ill patient, it is important for all to know that in any operation there is more or less risk of developing shock, hemorrhage, distention, failure of the kidneys to secrete, or of post-operative pneumonia. A nurse should know that a weak, rapid, compressible pulse may indicate shock or hemorrhage; that a distended abdomen may be a very serious complication; likewise failure of the kidneys to secrete; that chilling the patient, the aspiration of vomitus, blood clots or infected mucus into the lungs, or lying too long in one position may cause pneumonia to develop; and that a rise in temperature, increased respiration, or a slight cough may indicate the onset of pneumonia.

These conditions will be discussed in a later chapter.

Diet.—The diet, like all other treatments for the patient, is ordered by the doctor, but is determined by the operation and, to a large extent, the appetite of the patient.

At first the nausea and vomiting make the thought of food very distasteful to the patient and, if given, would not be retained. Gradually as this subsides and the normal secretions and peristalsis of the alimentary tract are restored the patient will desire nourishment and may be given light fluids unless the nature of the operation contra-indicates. Care must be taken to give the patient what appeals to him as it is important to build up the patient's strength and, while the stomach is still sensitive, it may easily be "turned" against food for several days longer if given something he does not like. Small amounts only should be given at first and every attempt made to tempt the appetite without forcing it. The care of the mouth is very important in all post-operative diseases.

Care of the Aged After Operation

All that has been said regarding the care of patients following an operation has an added importance in the care of either the aged or the very young. It is important to remember that in the aged all their powers of resistance are reduced. They are on the downward trend, the breaking down processes go on faster than the building up, their fighting powers are reduced so that they neither stand the operation nor respond to treatment well.

All the activities of the body, both mental and physical, are apt to be sluggish. They are more apt to suffer from shock. Their bodies do not produce much heat so special pains must be taken to keep them warm. Their stomach, intestines, skin, kidneys, and bladder do not function well. The diet, therefore, must be light, easily digested and assimilated but, as it is most important to build up their strength, it must be highly nourishing. Heavy foods must be avoided. The diet, too, must be tempting and it is important to remember that old people enjoy what they have been used to and cannot readily acquire a taste for new foods. The bowels must be kept open. Fluids are forced, to aid elimination by the skin and kidneys. Bathing, massage, and warmth are essential to stimulate the function of the skin. Catheterization is usually necessary to relieve retention of urine—care must be taken to avoid cold, exposure, and infection to which the patients' weakened condition and lowered resistance make them very susceptible. Old people are much more apt to develop pneumonia and bedsores, both of which must be guarded against. They are allowed up as soon as possible and strengthened by plenty of fresh air and sunshine.

A prolonged visit in a hospital is particularly trying for old people. It is so difficult for them to leave their home and friends, to adjust themselves to new surroundings, strange faces, a strange bed, probably less clothing while in bed, strange food, ways of cooking and serving and, what is very hard, to be deprived of familiar habits (such as smoking) to which they have become accustomed. Their habits should be interfered with as little as possible and when necessary or desirable it should be done with the greatest tact. They must not be allowed to fret and be unhappy for this drains their vital forces. They need all the reserve strength which a bright, cheerful mind will conserve.

Care of Children After Operations

Children require no special care differing from that of adults. They seem to stand the ether anesthesia and the operation much better than adults. They suffer less from discomfort and shock, etc.; the wound usually heals much faster; their recovery is rapid and often seems miraculous. Children do not stand gas anesthesia at all well.

Treatments Used in Surgical Diseases

The Vaginal Irrigation

This procedure consists in injecting into the vaginal canal, with little or no force, a solution of the required temperature. It is commonly called a douche but, strictly speaking, this is incorrect, as a douche involves the use of pressure. It is used in the treatment of both medical and surgical diseases.

Vaginal irrigations are used as a therapeutic measure in the following conditions:

1. Inflammation and congestion of the vagina or pelvic viscera.
2. Leucorrhea.
3. Hemorrhage from vagina or uterus.
4. A cleansing irrigation is usually given as a preparation for an operation on the reproductive organs or external genitals.

Contra-indications:

1. Before or during menstruation.
2. During pregnancy to avoid causing contractions of the uterine muscles with the danger of abortion.

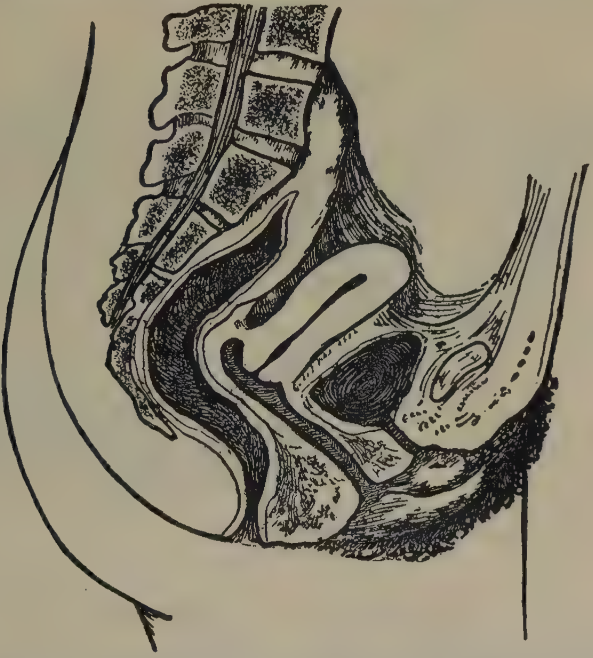

FIG. 100.—DIAGRAM TO SHOW THE CUL-DE-SAC BETWEEN THE CERVIX AND POSTERIOR WALL OF THE VAGINA. (From Kimber's "Anatomy and Physiology," Macmillan Co., Publishers.)

The effect of the irrigation depends upon the solution used, its temperature, and the method of giving the treatment.

The purposes for which they are given are:

1. To cleanse, disinfect or deodorize.—The *solution* used may be plain sterile water, or an antiseptic such as boric acid, lysol, carbolic acid, or silver nitrate, etc.; or a deodorant such as potassium permanganate or formalin. The *temperature* varies from 105° to 112° F.
2. To relieve pain, inflammation and congestion.
3. To stimulate the circulation and promote the absorption of exudates.

Astringents—alum, acetic or tannic acid—are used for inflammation and congestion.

Normal salt solution is sometimes used as a stimulating irrigation. The *temperature* varies from 118° to 120°.

4. To check bleeding.—Sterile water, boric acid, or astringent solutions are used. The *temperature* varies from 118° to 125°.

When giving the treatment, in order to get the best results, it is important to consider the following factors and principles:

Anatomical and Physiological Factors.—The vagina is the passageway between the uterus and the vestibule of the external genitals. The intravaginal portion of the cervix projects into the vagina at an angle so that a sort of pocket or cul-de-sac is formed between the cervix and the posterior wall of the vagina. Pus may collect here.

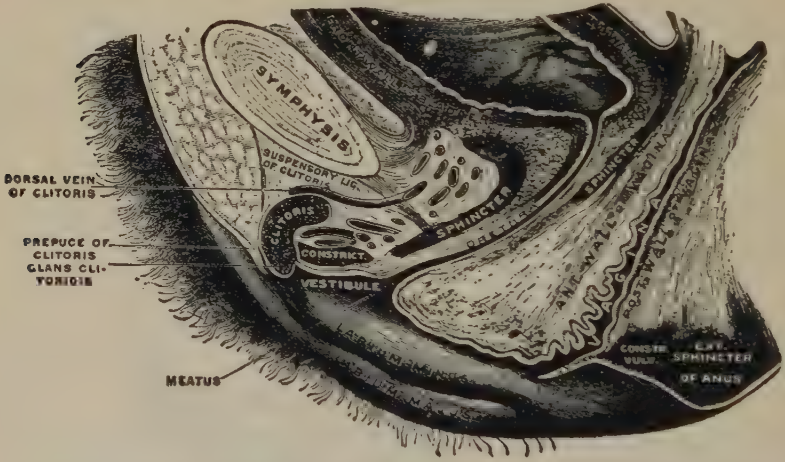
SYMPHYSIS
SUSPENSORY LIG. OF CLITORIS
DORSAL VEIN OF CLITORIS
CLITORIS
PREPUCE OF CLITORIS
GLANS CLITORIDIS
CONSTRICT.
VESTIBULE
SPHINCTER
URETHRA
SPHINCTER
ANT. WALL
VAGINA
POST. WALL
CONSTR. VULV.
EXT. SPHINCTER OF ANUS
MEATUS

Fig. 101.—Sagittal Section of the Vagina Showing the Transverse Folds and Hymen.

The *direction* of the vagina is upward and backward but its position varies somewhat with the position of the body and the condition of the bladder and rectum.

The *anterior wall* is about 2½-3 inches in length and is in close relation to the bladder and urethra.

The *posterior wall* is about 3½ inches in length and is in contact with the rectum, separated from it by the pouch of Douglas and the perineal body, etc.

The walls are normally in contact but the vagina is capable of great dilatation. The lower portion of the canal is the smallest and is further narrowed by the sphincter vaginæ and is partially closed by the hymen in the virgin. The mucous lining of the vagina is arranged in transverse folds which makes a thorough cleansing difficult. It is also continuous with that of the uterus and through the Fallopian tubes with the peritoneum so that infection may spread from the vagina and cause peritonitis. In relaxed conditions of the cervix the passageway (external os) is open. The walls are richly supplied with blood-vessels but both the cervix and the vagina have little sensation. There are no glands in the mucosa, the vaginal discharge being a transudate from the blood. It is acid in reaction and so unfavorable to the growth of bacteria. This acidity is increased during pregnancy. Unnecessary treatments (vaginal irrigations) not only lower the tone of the tissues but wash away this natural protection making the tissues more susceptible to infection.

Method of Procedure.—The articles necessary for the treatment are:—A douche pan, a douche can with tubing and stopcock attached, a douche nozzle, the solution ordered, at the required temperature (a nurse must always ascertain the purpose of the treatment), and provision for draping the patient and for drying the parts after the treatment, and a basin for the soiled nozzle. For the routine douche it is not necessary to have the can and tubing sterile, but they must be clean. The douche nozzle, however, must always be sterile by boiling for five minutes. As glass nozzles are frequently used care must be taken that they do not break or crack. A cracked nozzle must never be used.

These articles are brought to the bedside properly covered.

The Mental Reaction of the Patient.—Consideration for the feelings of the patient must never be forgotten. The patient may be receiving this treatment for the first time or, even if accustomed to it, will not be accustomed to the presence of another. Also in all treatments, even though the patient may lack the ordinary feelings of delicacy and modesty, the nurse owes it to the patient and to herself to maintain this attitude. The patient should be suitably screened, adequately draped and with no unnecessary exposure.

The Position of the Patient.—The patient should lie in the dorsal recumbent position with the shoulders low (remove at least one pillow) and the hips elevated so that the solution will bathe the cervix and all parts of the vagina. She should also lie perfectly flat in the center of the bed with the douche pan properly and comfortably placed so that there is no danger of the return flow soiling the bed. The pan should not be placed under the patient until the nurse is ready to give the treatment. It should be warm and covered with a pad or pillow for the comfort of the patient. The thighs and knees are flexed and the position made as comfortable as possible.

The gown should be neatly turned back to prevent soiling. In cool weather a blanket will be necessary to cover the chest.

The Insertion of the Nozzle.—Before inserting the nozzle examine it again to see if it is intact. Allow the solution to run through the tubing to warm it. Test the solution by the back of your hand. Cleanse the parts by allowing the solution to run over them. Insert the nozzle gently. In inserting it care should be taken to direct it upward and backward behind the cervix uteri to the farthest limit of the cul-de-sac (Kellogg) to avoid the danger of forcing the solution or infected material into the uterine cavity. The nozzle is provided with holes at the side and not at the end so that there is less danger of this taking place. The solution will then flow about the neck of the uterus and circulate through all parts of the vagina distending and bathing it. This results in both a local effect and a reflex effect (due to the temperature used) on the circulation of all the pelvic viscera.

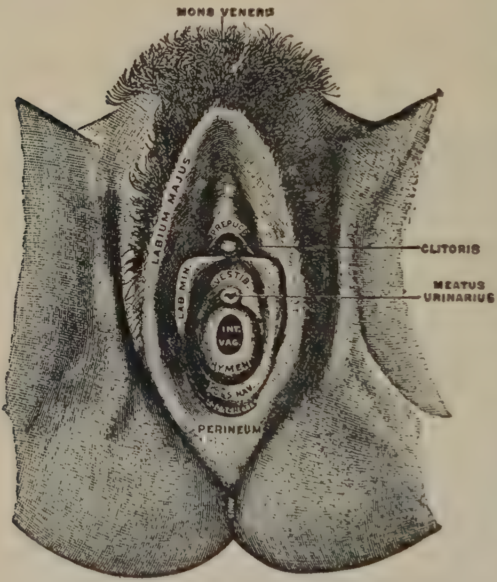

Fig. 102.—Vulva of a Virgin, Showing the Position of the Vagina.

The Duration, Force and Temperature.—The irrigation should be given slowly so that as far as possible the vaginal folds will be distended and the solution reach all parts and remain long enough to have a beneficial effect. Little or no force should be used in order to avoid the danger of forcing the solution into the uterine cavity. The can should, therefore, not be more than two or three feet above the patient. Hot irrigations are usually used because they lessen uterine excitability, muscular contractions, and pain. The benefit of the douche is due largely to the heat. Cold applications, while tonic and beneficial in their action, increase muscular contractions at first and so increase pain or discomfort.

The vagina being insensitive, very hot irrigations may be used without injury to the tissues but it must be remembered that the perineum and external genitals over which the solution flows are very sensitive and may easily be burned. This may be avoided by applying grease to the part so that the water does not come in contact with the tissue.

After-care of the Patient.—The pan should be removed as soon as the irrigation is completed. It may be left in place a few moments to allow any fluid which may be retained in the vagina to come away. During this brief interval the douche can, etc., may be removed from the bedside. The patient should be dried with the sponges or towel provided for that purpose and she should be made as comfortable as possible. The douche nozzle should not be allowed to contaminate the douche can but should be placed in the basin provided for it. It should never be placed in the douche pan with the return solution. Before putting it away, it should be thoroughly cleansed and sterilized. In carrying the utensils from the bedside, the tubing should be arranged so that a glass connecting tip, if used, will not be broken. The tubing should be unclamped to avoid injury to the rubber. The douche pan, can and tubing should be cleansed, dried and put away. The tubing should be unclamped when put away.

Charting.—The solution should be carefully examined, its character, and the amount used carefully charted. Douches are frequently continued when unnecessary because the nurse fails to indicate on the chart that the return shows the condition no longer demands the treatment.

The Sterile Vaginal Irrigation.—In the following conditions a vaginal irrigation must be a sterile procedure throughout on account of the great danger of infection through the relaxed external os or of a wounded or unhealed or, perhaps, bleeding surface. Care must be observed also to avoid all force.

1. After childbirth.
2. After an abortion.
3. After such operations as dilatation and curettage, perineorrhaphy, hysterectomy.

The douche can and tubing, the solution (and thermometer used for testing), the nozzle, douche pan, the draping, and the hands of the nurse must be sterile. In some hospitals of good standing for this procedure it is not considered necessary for the nurse to "scrub up" and the draping used and douche pan are not sterile in all instances.

Precautions in Infectious Conditions.—When the inflammation is due to infection by the gonococcus, care must be taken to avoid contraction of the infection or of carrying it to other patients. The nurse should wear a gown and rubber gloves and should be particularly careful to prevent any discharge being carried to her eyes. Goggles should be worn to prevent the discharge from spurting into the eyes. The utensils should be carefully marked, isolated, and used only for that patient. As there is usually considerable discharge, a basin with an antiseptic solution and sponge may be necessary to cleanse the parts before inserting the nozzle. The sponges should be handled with care and placed immediately in a paper bag to be disposed of.

Surgical Dressings

The responsibility for the preparation of the dressing-carriage or tray (instruments, solutions, dressings, etc.), doing minor dressings or assisting the doctor with dressings is usually assigned to an experienced nurse. A young student nurse, however, may have to make the dressings, and frequently assists by "turning down" or preparing the patient for the dressing; assisting a doctor (under the direction and supervision of the headnurse), or, perhaps, in some cases, assisting a nurse with minor dressings; sterilizing instruments, basins, etc., between dressings; applying bandages, binders, or adhesive strapping, making the patient comfortable after the dressing; and "cleaning up" after the dressings are all completed.

Very early in her training, therefore, before assuming such responsible duties, the nurse must grasp the principles underlying these procedures, the principles of antiseptic and aseptic surgery based on the science of bacteriology. But a clear understanding of the principles is not enough. A nurse must have a conscience which fully accepts the responsibilities implied in these principles and govern her application accordingly. In addition, constant observation and frequent opportunity for practice are necessary as a basis of skill—the repetition over and over again until correct habits are formed and a "break in technique" impossible.

We are told, and also know from experience, that we only "learn by doing," that habit rules us but it also never fails us and that a thing is not learned until it becomes a part of our nervous system and of our very muscles or structure.

Antiseptic and Aseptic Surgery.—Entering one of our modern hospitals to-day—so bright and orderly, so clean and free from odors, so quiet, free from groans or cries of torture, so busy, with patients waiting to be admitted, with others sometimes loath to go home—it is hard to realize that such a short time ago, within the experience of nurses and doctors on active duty to-day, that a hospital could be called the "House of Crime," that "in some maternity hospitals there was an attempt to hide the great death rate from the public by putting two bodies in one coffin," that the death rate after amputation in hospitals was over 60 per cent., or that a noted surgeon of the Charité Hospital in Paris used to say to his pupils, "When an operation seems necessary, think ten times about it, for too often when we decide upon an operation we sign the patient's death warrant." It seems almost impossible to believe that, in the American Civil War (only about fifty years before the recent World War, during which such marvelous operations were performed), "almost all abdominal and head wounds proved fatal; and when the driver of an ambulance wagon was asked if he knew how to treat wounded men, he replied, "Oh, yes, if they are hit here—pointing to the abdomen—knock 'em on the head: they can't get well."

In view of these facts, it is not hard to understand why many, ill-informed of present conditions, but who remember the tales told by their parents, fear to enter or allow their children to enter a hospital; nor is it hard to understand the feeling, often expressed, that nurses and doctors become hardened and callous.

The explanation for the tragic conditions then existing lay in the doctrine then held (before and even after 1867) that "Disease is in us, of us, by us," and in the fact that Lord Lister had not yet established the relation of microörganisms to wound infection and suppuration and demonstrated the value of the use of antiseptics in preventing infections. We can understand the appalling death rate from wounds and operations when we read that "the region of the wound rarely was washed, the surgeon generally carried his dressings in his pocket, his needles and sutures in his medicine-case, and washed his hands after rather than before operations," with the result that "practically all wounds were infected, fully 90 per cent. suppurated, post-operative pus was supposed to be a normal accompaniment of repair, and the death rate from pyemia, septicemia, tetanus and erysipelas after severe traumata and surgical operations was very high." (Brewer.)

These conditions in the hospitals of to-day (as a result of operations) are almost unknown because of the application by Lord Lister (the Father of Modern Surgery) in 1867 of the discoveries of Pasteur—the germ theory, the relation of microörganisms to the processes of fermentation and putrefaction—to the relation of microörganisms to wound infection and suppuration. This resulted in the introduction of antiseptic surgery—the "daughter of Science and Art" as nursing is also the daughter of Science and Art for, in surgery as in nursing, the science without the art or skill to carry out its teaching can do the patient little good and may even do harm. Lord Lister's success depended upon this—that he not only possessed the knowledge and the imagination but the will, the patience and skill necessary to carry out to the minutest detail the principles which science unfolded. Others during and before his time knew all that science then could teach but they lacked the art, the skill, and the technique.

As surgery develops in science and in art she depends more and more on her sister nursing which must therefore strive to keep pace with her.

Antisepsis.—Antiseptic surgery was based upon the belief that germs were everywhere; so that, in order to prevent wounds from becoming infected, it was thought necessary to slay the germs not only on everything—hands, instruments, dressings, etc.—which would directly or indirectly come in contact with the wound, but to kill all those already in the wound, and all those which might remain in the wound or be brought to it, by the generous use of antiseptics on the dressings. Wounds were cauterized with pure carbolic to kill those thought to be already in it.

This method has certain disadvantages: It is difficult to secure an antiseptic which will kill or prevent the growth of bacteria without at the same time injuring the tissues and delaying the healing process, or which, by its absorption, will not poison the system. Some of the antiseptics in general use are bichlorid of mercury, carbolic acid, boric acid, iodoform, alcohol, peroxid of hydrogen, and Dakin's solution: The use of Dakin's solution in infected wounds has met with marvelous success. It kills the germs and without injury to the tissue of the wound. We are told, however, that its success lies not in the solution used (science) but in the art or method worked out by Dr. Carrel for its use—without this technique accurately carried out, Dakin's solution will not clear up infected wounds whereas, with this technique, some believe that any (even mild) antiseptic will do so. Science and Art must proceed together.

With further experimentation and experience in the treatment of wounds it was gradually recognized that in wounds not already infected the use of strong antiseptics, or indeed the use of any antiseptic for dressings, was unnecessary. This alteration in the treatment of wounds and the acknowledged success of the new methods led to the famous remark in the London *Times* that "Lister's arguments grew stronger as his solutions grew weaker."[1]

To-day the antiseptic method is used only for wounds already infected when it is necessary to destroy the germs or prevent further development and give the tissues a chance to recover.

Asepsis.—In aseptic surgery the idea is to prevent bacteria from gaining access to the wound or approaching it directly or indirectly. The two weak points are the air and the skin of the patient, neither of which can be rendered sterile but from which the possibilities of infection (under present conditions in the hospital) are slight. This method is used for all cases free from infection at the time of the operation. It can only be safely used under the most favorable conditions and by those who thoroughly understand and apply the principles.

Making Surgical Dressings.—Surgical dressings are required for the following purposes: (1) To cleanse wounds; (2) to pack wounds, keep them open and provide free drainage; (3) to absorb discharges; (4) to apply ointments, etc.; (5) to protect the wound and keep it sterile by excluding bacteria or contact with unsterile objects; (6) to protect the patient's gown and bed linen.

The materials used for making such dressings are chiefly gauze, lint, absorbent and non-absorbent cotton.

Gauze is loose meshed, absorbable and easily sterilized. Its disadvantage is that it is rather harsh and irritating to a raw open wound to which it is apt to become adherent causing difficulty and pain on removal. Its great disadvantage is that when cut it frays. In making dressings, if all raw edges are not securely turned in, the ravelings cling to the raw surface, becoming enmeshed in the tissues, and act as a foreign, irritating body in the wound. This would keep up the inflammatory process and prevent healing. Gauze is made into loose balls or fluffs or folded into flat compresses, wipes or sponges. These may be of special shapes and sizes, the essential point being to have all raw edges turned in. They are applied next the wound to protect, apply ointments, or absorb discharges, etc.

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[1] "The Romance of Medicine," by R. C. Macfie, M.A., Aberd., M.B., C.M.

Gauze with absorbent cotton is also made into pads which are placed outside the gauze compresses for absorption and protection. The outer pads contain also a layer of non-absorbent cotton to protect both the wound and the patient's gown and bed linen. Make pads the required size, smooth, not lumpy, with all raw edges of gauze turned in.

Gauze for Packing and Drainage.—When there is possible infection in a wound it is left open to allow for the escape of fluid or pus which may collect. The wound must be kept open by packing it with sterile gauze or a rubber drainage tube, etc.; otherwise it might heal over on the surface and allow a pocket of pus to collect beneath. The gauze acts as a wick to absorb and drain the discharge. All wounds are not of the same depth or diameter and as healing takes place they become smaller so the strips prepared for dressings must differ in width. In making the packing, gauze bandage is usually used to avoid the raw edges of cut gauze. Bandages of the desired width and cut the desired length are usually folded or plaited so that they can be packed into glass tubes plugged with non-absorbent cotton and sterilized. The gauze may be plain or medicated, that is, impregnated with an antiseptic or stimulating drug such as iodoform. If gauze bandages cannot be secured then plain gauze is cut into strips. The raw edges are folded toward the center of the strips, the double edges are then brought together making a strip of four thicknesses.

Absorbent cotton is made into round pledgets or balls in such a way as to form a stem to hold with fingers or forceps. They are used for cleansing the wound.

Surgical dressings are put up in various ways to be sterilized. They are sometimes put up in small packages, the required number being wrapped in cotton wrappers of double thickness. They are so wrapped that the package may easily be opened and handled without danger of contaminating the sterile dressings within. No part of the pin used in fastening, except the head, should be exposed. These packages are then all put in a bag and sterilized by steam under fifteen pounds pressure in the autoclave for forty-five minutes and dried under fifteen pounds pressure for forty-five minutes. Sometimes the dressings required for the day on a surgical ward are packed in metal boxes. They must be tightly packed in neat piles so that the dressings required may be selected without disturbing or unnecessarily touching (even with sterile forceps) the other dressings. The dressings in the box should be covered by a layer of gauze. These are also sterilized in the autoclave as explained above.

Surgical dressings are a very heavy item of expense to the hospital. The most strict economy must be observed both in the making and using of all materials and dressings.

Preparation of the Patient For a Dressing

Before dressings are begun, the ward should be quiet and in order, with screens in readiness for use, the patients in bed, the beds in order with no unnecessary articles in the way, the preparation of the dressing-carriage completed, and one or two nurses in readiness to assist.

The patient, his gown, and the bed linen should be scrupulously clean. His position depends upon the area to be dressed, but is most frequently the dorsal recumbent position. It should be made as comfortable as possible and free from all strain. For instance, he should not be obliged to raise his head or an extremity, for the application of a dressing or bandage, without support. At the same time the position should be convenient and such as to aid in the performance of the dressing. The arms and hands should be placed so that they may be out of the way and in no danger of contaminating or interfering with the dressing. Usually it is wise to turn the patient's head away to prevent the sight of the wound from increasing the fear and discomfort or intensifying the possible pain present. Sometimes, when the pain is very great, the patient is helped by holding tightly to the sides of the bed or to the hand of the nurse. When a wound is to be irrigated the patient should be drawn to the side of the bed. When extra pillows, a back rest, or Gatch frame interfere with the dressing, the pillows should be removed or the back rest lowered.

The arrangement of the clothing will depend upon the area to be dressed but in all the following principles should be observed:

The upper clothing, except the top sheet, should be turned back neatly and smoothly so as to allow a free area around the wound for the dressing with no bulky folds to interfere with it. The upper sheet should then be turned back forming one thin flat fold at the margin of the area. Avoid any unnecessary exposure. Avoid chilling the patient—remember the danger of pneumonia in post-operative cases. For instance, when the dressing is on an abdominal wound, the spread and blanket should be turned back neatly and smoothly to the foot of the bed. When the weather is cool or there is any danger of chilling, a chest protector or folded blanket should first be placed across the chest. The sheet is folded down smoothly to within two or three inches of the blanket and spread. The patient's gown is tucked back smoothly out of the way. When drainage from the wound is free or when the wound is to be irrigated, dressing rubbers are used to protect the bed and bedding. When a large amount of solution is to be used, a Kelly pad may also be necessary, so arranged as to collect the fluid and drain it into a pail on the floor.

The bandage or binder confining the dressing is then removed, casts or splints and other appliances are also removed when necessary. The adhesive strapping is then removed or unfastened on one side. When a daily dressing is necessary sometimes "tape-strapping" or adhesive straps to which tape is fastened and tied over the dressing is used—these are untied. When removing adhesive strapping pull it on each side toward the wound to prevent pain and strain on the sutures or wound. Remove it quickly as this is much less painful than when removed slowly. When the skin is very tender sometimes the adhesive strapping is cut at each side of the dressing and the fresh straps applied over the old. The outer dressing is never removed until the doctor is ready to begin the dressing.

Preparation of the Second Patient.—While the dressing for the first patient is being done the second patient may be prepared. This preparation may be for a wound of the head, chest, or extremities, etc., but in all the principles involved are the same. The order in which the dressings are done is important —"clean cases," that is, uninfected wounds, are always dressed before infected wounds to avoid the danger of spreading infection.

Completing the Dressing and Making the Patient Comfortable.—Dressings are secured in place by the application of adhesive strapping, binders, or bandages.

To Apply Adhesive Strapping over the Dressing.—First remove any adherent particles of adhesive with benzine or alcohol —these particles are unsightly and very irritating, causing a most uncomfortable itching if allowed to remain. If the skin is abraded, hot water may be used.

Adhesive strapping is applied (1) to hold dressings in place; (2) to draw the edges of the wound together and to relieve strain on sutures; (3) to give support to the muscles of the abdomen, especially when thick and pendulous.

When applied over a dressing on the abdomen, therefore, the straps should be wide enough and should be applied tightly and firmly enough to give this support and prevent the pull of the muscles on the wound and sutures. Narrow strips cut the skin, give no support, dry up, and peel off quickly. In order to give support the straps must be long enough to extend well around to either side. It may be necessary to pad prominent hip bones where the skin is thin and apt to become sore. Do not extend the straps farther than necessary as they are uncomfortable, painful on removal, and the excess use is also extravagant and wasteful. When there is infection in the abdominal cavity and it is desired to localize the pus in the pelvic cavity, adhesive strapping is applied from above downward. If the first straps are applied to the lower abdomen, the pressure tends to spread the infection upward through the abdominal planes of fascia, etc. When there is no infection and firm support is desired it is better to have the support from below upwards. When applied from the waist downward the straps do not give the necessary support and, as the waist is smaller than the hips, by the time the lower straps are applied the upper will be wrinkled, loosened, and uncomfortable. The first strip should be across and over the lower border of the dressing, partly on the skin and overlapping the dressing so that the lower border is completely sealed in order that the fingers or any foreign matter cannot get up under it, and also in order that discharge cannot escape to spread infection. The following strips are applied in the same way from below toward the waist. To apply the strap, first fasten securely on the opposite side, then draw it toward you over the dressing with one hand and with the other gently but firmly press the abdominal wall toward the wound (away from you), and quickly and securely fasten the adhesive in place. This draws the edges together, relieves strain and gives support so that the patient is more comfortable, does not feel as though she were "coming apart" and is not afraid to move. Do not apply over an abraded skin. When a daily dressing is necessary, to avoid sores and the pain and discomfort to the patient of the daily removal of adhesive, sometimes "tape-strapping" or strips of adhesive to which tapes are attached are fastened on either side and tied over the dressing. These are useless when support is necessary. When used they should be removed when soiled, when the edges are curled, or when adhesion is lost.

Binders and bandages are frequently used to secure dressings in place and for other purposes. They have been discussed in the chapter on bandaging.

When the dressing has been secured in position, the dressing rubber, draping, etc., are removed from the bed. The soiled instruments will have been collected in a basin and placed in a suitable place on the carriage. The soiled dressings are also frequently collected in a receptacle attached to the carriage—when collected in a paper bag they should be placed in the garbage tin immediately.

The bedding is straightened, the pillows adjusted, the bedside table replaced (if moved), and the patient is made as comfortable as possible. The soiled linen is placed in the hamper, the dressing rubber, if soiled, removed to be cleansed, irrigating solutions are removed, basins or pails, etc., are cleansed, disinfected, and dried.

If the patient has been exhausted by the dressing her nurse should give her a hot or cold drink which will be stimulating and refreshing.

STERILIZATION OF INSTRUMENTS, BASINS AND TUBING

Instruments.—Frequently when a number of dressings are to be done, there is not a sufficient supply of sterile instruments to complete the dressings without resterilizing them between dressings. A probationer may be responsible for this very important procedure. She must be careful in observing the principles of asepsis in the most minute detail, remembering that by not doing so she may carry infection to the wound and endanger the life of the patient. "A chain is only as strong as its weakest link."

Before sterilizing the instruments, first cleanse all discharge or blood from them with cold water. All discharges from the body contain albumin: Cold water dissolves albumin while heat coagulates it and makes it difficult to remove. Separate the sharp instruments from the dull.

To sterilize dull instruments, immerse them in boiling water containing 1 per cent. of sodium carbonate, which preserves the instruments. Allow them to boil for from 5 to 10 minutes. See that the water is boiling before immersing the instruments as too long exposure to moist heat is injurious and only actively boiling water will kill organisms. The instruments must be completely covered. All hinged instruments should be unclasped.

Sharp instruments, except knives, are boiled two minutes. Heat blunts points or blades and dull instruments make treatments very difficult and cause the patient severe and unnecessary pain. (They should be sharpened frequently.) Sharp instruments should not be boiled with dull instruments. Scissors should be unclasped and blunt ends should be immersed first. Sharp instruments such as knives or scalpels are not boiled longer than one minute. In some hospitals they are sterilized by immersion in alcohol 70 per cent. for thirty minutes or in carbolic 5 per cent. for thirty minutes. Instruments should never be placed in bichlorid of mercury as it corrodes and ruins them. Cutting points or edges should be protected with cotton and they should not be allowed to come in contact with any hard surface. When this can be prevented without wrapping the points in cotton it is better because cotton also dulls the edges.

Hollow needles, such as infusion and aspirating needles, etc., must be carefully cleansed with cold water to remove any albuminous substance, then carefully tested before boiling. For boiling, the wire is first removed and needle and wire inserted separately in gauze. The wire may be left in the delicate hypodermic needle. The canal is so small that salts, always present in hard water, may completely clog it if the wire is left out. The heat is sufficient to sterilize all parts of the needle and wire.

Glass Syringes and other Glassware.—First cleanse from all albuminous matter. Test syringes to see that they are working. Immerse in cool water to avoid breaking; let the water come to a boil and then boil five minutes.

Enamelware such as Basins.—First cleanse thoroughly. Boil for 5 to 10 minutes or when this is impossible they may be immersed in a solution of bichlorid of mercury 1:2000 for one hour.

Enamelware in which the enamel is worn off should not be used for sterile dressings because the roughened surface renders it more difficult to make and keep sterile.

Rubber Tubing.—Tubing should be cleansed with cold water both inside and out, allowing the water to run through freely, then with warm soapy water. Rinse off the soap, as it deteriorates the rubber. Immerse in actively boiling water and boil for five minutes: Do not leave in the hot water longer than is necessary as heat softens and ruins rubber. Rubber tubing should not be boiled with instruments or with carbonate of soda as both may injure and destroy the rubber. See that rubber goods are thoroughly covered, and do not float on top of the water, or come in contact with the sides of the basin—wrap in gauze and use a weight when necessary. Rubber tubing may be disinfected by immersion in antiseptics (when not needed promptly)—alcohol 70 per cent. for 15-30 minutes or bichlorid of mercury 1:5000.

Rubber Tubing for Drainage.—In a discharging wound rubber tubing is frequently used to keep the wound open, to stimulate and allow free drainage. This may be removed during the dressing and must be cleansed and resterilized at once to be reinserted. Handle all such infected tubing with forceps. Cleanse with cold water and boil for five minutes. The safety pin usually attached to the tubing will be sufficient weight to keep it from floating.

Final "Cleaning up" After Dressings:—Cleansing and Sterilization of Instruments.—In addition to the rules already given, the following care is necessary:—First count the instruments to insure that none were accidentally disposed of with the soiled dressings; then thoroughly scrub them with bon-ami or whiting, giving special attention to joints. Needles may be cleansed from rust and spots by the use of emery powder: They must be sharpened frequently. Hollow needles must be thoroughly cleansed by passing the wire repeatedly through them to remove any obstructions, and tested by drawing water through them with a syringe. Rinse the instruments with clear hot water, drain, and dry thoroughly with a soft cloth. Dry between the joints carefully and leave unclasped; dry hollow needles by repeatedly inserting the wire, drying it each time until the wire returns quite dry.

Put the instruments away. Send knives or other sharp instruments to be sharpened if necessary. When put away, if possible, place so that the blades will not come in contact with anything hard. They may be placed on layers of gauze or protected by winding absorbent cotton around them—the cotton itself, however, dulls the blades of fine knives. The best method is to have a box prepared in which sharp instruments such as scalpels may rest on a support so that the blade is not in contact with any surface.

Glassware, Glass Syringes, etc.—Cleanse with cold water, hot soapy water and sterilize. Before putting glass syringes away test to see if in working order, dry and return to the proper place.

Enamelware.—Cleanse with cold water, scrub with soap, bon-ami, and hot water. Sterilize by boiling 5-10 minutes or by steam under pressure, or by immersion in a solution of bichlorid of mercury 1:2000 for 1 hour, or in formalin (1 ounce to 1 gallon) for one-half hour.

Rubber Goods.—Rubber tubing used for drainage in a wound, when no longer necessary, is thrown away with the soiled dressings. Rubber tubing used for irrigating should be cleansed with cold water, then with warm soapy water, flushing the inside thoroughly, then rinsed. Dry carefully with a towel and squeeze out the water by repeatedly drawing it between the fingers. Hang up to dry over a towel, spread out so that there are no sharp angles. Rubber when dry is apt to crack. Put away in the proper place.

Rubber Dressing Sheets.—First remove all albuminous matter with cold water. Then cleanse with warm (not hot) water and soap; if cleansed immediately stains may easily be removed. Other cleansing agents such as Dutch cleanser should be used only when absolutely necessary; they are gritty and ruin the rubber. When used for a septic case, disinfect by immersing in an antiseptic solution—carbolic acid 1:40 for an hour or formalin 2 per cent. for one-half hour. Then rinse and dry. When hanging up to dry or when putting away avoid creases as they are apt to form cracks as the rubber dries.

Rubber Gloves.—As it is impossible to sterilize the skin, rubber gloves are frequently used for surgical dressings.

When discarded after the dressing, rubber gloves should never be thrown in the basin with soiled instruments or with soiled dressings.

To Cleanse and Sterilize.—First wash immediately with cold water. Then cleanse with warm water and soap, turning the gloves inside out. Rinse with warm water. Test the gloves for needle pricks, etc., by filling them with water and noting any air bubbles which indicate a puncture. Gloves with holes are a source of danger both to the doctor and the patient. The smallest hole is large enough to allow the invasion of bacteria and infection of the doctor's hands. Also the doctor's hands are not sterile, the gloves cause increased perspiration which may, through a hole in the gloves, infect the wound. Gloves with holes are set aside to be mended.

When sterilized in the autoclave (steam under pressure) the gloves are thoroughly dried inside and out, especially between the fingers, mended, tested again, etc., arranged in pairs, enfolded in a special glove case, and sterilized for twenty minutes.

When sterilized on the ward, ready for use, they are boiled in water containing salt (which keeps the rubber from becoming soft) for five minutes. See that they are thoroughly immersed and protected from the sides of the basin. Sometimes they are wrapped in gauze, sometimes placed in a muslin hammock and a weight used to keep them from floating. They are then dried with sterile towels, powdered inside and out with sterile powder and put away ready for use in a folded sterile towel. When prepared in this way the nurse must be "scrubbed up," that is, her hands must be sterile.

The care of the dressing-carriage belongs to the senior nurse, Soiled dressings should always be securely enclosed in paper bags and burned at once or placed in the garbage tin, which should be kept covered and emptied frequently.

ASSISTING WITH SURGICAL DRESSINGS

In some hospitals a young student nurse will never be required to assist with dressings; in some, she may be allowed to assist a doctor under the direction and supervision of the head-nurse; and in others, where senior nurses are required to do minor dressings, she may be taught to assist a nurse.

Having learned the principles of aseptic surgery and applied these principles in the sterilization of instruments, etc., the nurse, if also allowed to observe dressings, will have learned the following important facts:—that everything which approaches a wound must be surgically clean; that an article may be clean but not surgically clean; that a sterile article is no longer sterile if exposed to the air too long (as in leaving the lids off sterile jars, etc.) or if touched by an unsterile object; that the outside of bottles, jars, packages, basins, metal boxes, etc., may be unsterile, while the contents are sterile; that those contents, however, are no longer sterile if allowed to touch the rim or outside of the container; that the outer surface of a dressing is not sterile, neither is the instrument used to remove it any longer sterile; that the surface of a sterile towel which touches the bedclothes or a dressing rubber is not sterile; that sterile articles are liable to be made unsterile if placed near unsterile articles; that sterile goods (instruments, basins, etc.) are rendered unsterile if unsterile ones are placed with them to be sterilized—in this case the whole must be resterilized; that the skin can never be made absolutely sterile even though "scrubbed up" so that even sterile (?) hands must never be used to test the temperature of a sterile solution or inserted into a jar for a dressing, etc., and that it is necessary to use a sterile thermometer and sterile forceps; and that sterile (?) hands are rendered unsterile if allowed to touch anything unsterile.

Before being allowed to assist with a dressing, a nurse should familiarize herself with the way in which the principles of aseptic surgery are carried out in the arrangement of the contents of the dressing carriage in order to carry out these principles with skill, anticipating and supplying promptly the needs of the doctor or nurse she assists, and avoiding any movement which would contaminate articles coming directly or indirectly in contact with the wound.

The sterile articles—towels for draping, instruments, solutions, ointments, powder, tubing, syringes, dressings, etc., will be found on the top shelf in the most convenient place, always in the same place, according to the frequency with which they are used, and in the order of which they are usually required. A jar containing sterile forceps in an antiseptic solution, to be used for passing sterile dressings, etc., to the doctor or nurse doing the dressing will also be kept on the top shelf.

The reserve sterile supplies or those occasionally used are placed on the lower shelf, together with the unsterile supplies —dressing rubbers, bandages, binders, etc. Room is left on this shelf for the soiled articles such as basins.

To assist with the dressing, first screen the bed and wheel the carriage to the opposite side of the bed on which the senior nurse will stand. Prepare the patient while the doctor or senior nurse is "scrubbing up." Arrange sterile and unsterile articles in the most convenient position. Open packages of sterile towels, dressing basins, etc. (if kept in packages) and pour out solutions ready for use. First wipe off the rims of the bottles with sterile cotton and alcohol. Never put stoppers down or allow them to come in contact with an unsterile object.

When the doctor or nurse is ready to begin, remove the outer pad of the dressing, or the "clean" nurse may remove it with sterile forceps which are then discarded as they are no longer sterile. If required to arrange the sterile draping, handle it only by the extreme corners. During the dressing the duties of the "unsterile" nurse are to pass (with sterile forceps from the jar of antiseptic solution) to the "clean" nurse, as required, sterile instruments, tubing, dressings, etc., and to pour out cleansing and antiseptic solutions. When irrigation is necessary the "unsterile" nurse arranges the irrigating can with tubing attached and pours in the solution—the lower end of the tubing is usually kept separate and is handled by the "clean" nurse only.

When required to support or restrain the part being dressed, hold the part underneath the sterile towel.

In handling sterile basins, etc., never put the thumb or fingers inside—this will unsterilize it. In handling contaminated basins —basins with soiled dressings, instruments, discharges, etc., never put thumbs or fingers inside to avoid grossly contaminating your own hands. Never touch soiled dressings with your fingers. The outer pad of the dressing (handle outside only), the adhesive, and binder, etc., should be applied only by the nurse whose hands have not become contaminated, in order to avoid spreading the infection.

During the dressing there should be no unnecessary or irrelevant conversation, no remarks which might alarm the patient—the conduct should be such as to reassure the patient, to make her feel that your one interest and concern is for her comfort and welfare and such as to give her confidence in your knowledge and skill.

By so assisting with dressings early in her training the young nurse is, so to speak, apprenticed to the headnurse or to a senior nurse—one who has mastered the principles and the technique, one whose duty it is to teach, who recognizes and sympathizes with the eagerness to learn and with the difficulties of the young nurse who is, therefore, not afraid to ask questions, as she sometimes is of the doctor—afraid to "bother him," to "take up his time," to "ask foolish questions" and to receive answers too technical sometimes for a young nurse to understand.

CHAPTER XIX

THE DEPARTURE OF THE PATIENT FROM THE HOSPITAL

Health, Social, and Economic Aspects.—A serious illness and all the incidents connected with it usually make a lasting impression on one's mind. An illness which necessitates a more or less prolonged period in a hospital, together with all the varied feelings and experiences attached to it, is much more of an event and ordeal and makes a more lasting impression. The first impressions, on the day of admission, and the last impressions, on the day of departure, are apt to be particularly vivid and lasting. An unpleasant experience, a thoughtless, unkind act, on the eve of departure may blot out to a large extent the grateful recollections which the patient should carry away of the excellent care received during his illness. This must be avoided. Attentions received on the day of departure should be just as considerate, although of a different nature from those received during the acute period of his illness. The usual procedure is as follows:

When the patient is well enough to go home, the doctor usually indicates this fact by signing the patient's chart (if the patient leaves against the advice of the doctor, he is usually required to state this fact in writing before being allowed to leave). The nurse in charge of the patient should see that he receives his clothes and valuables and any assistance required in dressing. It is customary to have the patient sign the record book indicating that the articles returned to him are complete. The nurse should see that the clothing is in good condition, suitable to the weather, and that proper provision is made for his journey and safe arrival home. She should make him feel that he is leaving friends behind who rejoice, not in his departure, but in his recovery. He should not be hurried as though we were glad to get rid of him. He should be made to feel that our concern for him does not end with his departure but that we are interested in his future welfare. If he is in need of help of any kind we should do our best to give it. For instance, a mother may need instructions in making the formula prescribed by the doctor for her baby's feeding, or in the proper method of feeding the baby, and in his general care. Another patient may not understand the directions given him by the doctor regarding his diet, treatments, or dressings, or instructions regarding future visits to the Out-Patient Department for examination or treatments, etc. These instructions should be made clear to him. Very often patients although pronounced cured will require further care after leaving the hospital. For it is now recognized that all the good work accomplished in the hospital may be undone by lack of instructions, by neglect and worry, and by circumstances which force a patient to go to work too soon or to work at unsuitable employment. They are often quite unable to go back to work immediately and may be friendless and without means of support. When such is the case, the circumstances should be explained to the nurse in charge of the Social Service Department, who will see that such patients are properly cared for.

This **teaching and "follow-up"** method of treating patients has, during the last few years, been greatly extended, not only from a social and economic but from a health standpoint, that is, the complete restoration of the patient. It is now not considered sufficient to perform a successful operation or to treat the patient for the particular condition which brought him to the hospital—his teeth, nutrition, health habits, and all other health factors must be attended to. In order to accomplish this, to know the end results, and so to test the treatment given, patients are followed and return for periodic examinations sometimes over a period of years. This helps to establish the habit of periodic health examinations and so greatly promotes the prevention as well as the cure of disease. In all of this the nurse plays a most important part which requires not only a knowledge of health and disease but of the social and economic factors which promote health and prevent disease.

In St. Luke's Hospital of New York City, it is customary for the Assistant Superintendent to visit each patient before their departure for the purpose of finding out whether he or she is satisfied with the attention and care the hospital, doctors, and nurses have given them. This gives the hospital authorities an opportunity to hear any possible complaints at a time when they can be investigated and any misunderstandings can be corrected. It also makes the patient feel that he is receiving individual attention and he leaves feeling satisfied that the hospital has his welfare at heart. A nurse escorts the patient to the main office of the Administration Department, where he is formally discharged. The nurse bids him good-by as she would a guest in her own home.

While it is the aim of the hospital, doctors, and nurses to send all patients home cured, it is inevitable that some will not recover and will pass away as the result of a severe illness or a critical operation. It will then be the duty of the nurse to give the following care.

Care of the Body After Death

A very young nurse will never be asked to care for the body alone, but she may be required to help an older nurse in such duties. This is not because of any special skill required, for the procedure itself is simple, but because the actual contact with death, perhaps for the first time, is apt to be very depressing to the young and inexperienced mind. As the young nurse gradually becomes more experienced and familiar with suffering and distress, death is in many cases recognized as a blessing and release from suffering, and the fear and dread are somewhat overcome by sympathy and a sense of her duty as a nurse toward the patient and his relatives. There are few patients who die who are not mourned by some relative or friend by whom they are loved and to whom their body is still a precious thing to be treated tenderly and reverently. The care after death is the last tender office which can be performed for the dead and will willingly be entrusted by relatives only to those who are sympathetic as well as skilled. To make the body, especially the face, look as natural and beautiful as possible and to perform this last duty as we would wish toward one we ourselves loved should be our purpose in this case.

A patient who is critically ill and about to die will be screened from other patients. Friends or relatives, where possible, will have been notified of the patient's serious condition and may be present. They should have the comfort of knowing and feeling that everything they could do and that everything the hospital, doctors, or nurses could do has been done for the patient. A nurse should remain constantly with the dying patient unless he or his relatives wish to be alone. The doctor will, of course, have been notified of the patient's condition. If not present when the patient ceases to breathe, he should be notified of this fact at once. The nurse should note the exact time at which the patient ceased to breathe. (This is entered on a card bearing the date, the ward, the patient's name, and the signatures of the doctor and nurse, and is immediately taken to the main office.) A nurse can take no steps toward the preparation of the body until the doctor has pronounced the patient dead. Also, if members of the family are present, the first few minutes belong to them. During this time the nurse can make the necessary preparations. As soon as possible after the patient ceases to breathe, the body should be straightened and placed in the dorsal recumbent position. Shock blocks, back-rest, and all pillows except one, should be removed. If the patient is on an air mattress, allow the air to escape so that the body will rest on a firm support. If this is not done promptly, it is impossible to obtain a look of peace and repose, as the body quickly becomes rigid after death. Particular attention is given to the face. The eyes should be closed immediately. The face is bathed and the hair brushed and braided. The mouth should also be closed and the jaw held firmly in place with a bandage. False teeth or plates if formerly used should first be inserted. One pillow is left under the head to keep it slightly elevated and prevent the congestion of blood in the small blood vessels. The natural color and beauty of the face depend to a large extent upon avoiding this congestion. During the embalming process, later, as far as possible, all the blood from the blood vessels is removed.

If congestion has taken place in the small blood vessels of the face it is very difficult, sometimes impossible, to withdraw the blood. Consequently the face becomes discolored or mottled. The appearance should be as of one free from care, resting in a quiet, peaceful sleep.

All unnecesary articles such as shock blocks, a back-rest, pillows, blankets, ice-caps, hot-water bottles, rubber rings, etc., should be removed from the bedside. They should be cleansed or disinfected when necessary or restored at once to their proper place. The upper bedclothes are removed except the top sheet. The gown is also removed. Soiled linen is put at once in the hamper. The table is cleared as for a dressing and the necessary articles for bathing and preparing the body are brought to the bedside. The bed and surroundings should present a picture of neatness and order. Before proceeding with the bath, all rings (including wedding rings), earrings, bracelets, beads, or other articles worn should be removed and placed in a separate package with other articles of value, such as money, jewelry, receipts, eyeglasses, letters, keys, etc., and any emblem of sacred or religious meaning. An itemized list of such valuables should be made and later, together with the package, taken to the main office of the Administration Department. When earrings or rings, etc., cannot be removed, a note to this effect should be made on the list of valuables. When it is requested by members of the family that a wedding ring, etc., be allowed to remain on the body, it should be securely tied on with a bandage. It is wise to have such requests in writing and such written requests should be left in the main office. Any carelessness regarding such personal belongings is inexcusable. There is nothing too small to be listed and sent to the main office. That which seems of trivial value to us may be, on account of its association, of untold value to a sorrowing family.

Soiled dressings should be replaced with fresh dressings. All drains, pieces of rubber tubing and artery clamps, etc., if attached to tubing in a surgical dressing should be removed. Adhesive marks should be removed with benzine. If the dressing is one where there is likely to be a great deal of drainage, see that plenty of cotton is used. Dressings at this time are not sterile. Proceed with the bath as for a patient in life. An oakum pad and a diaper of old muslin are applied to prevent the escape of feces from the relaxed anus. The mortuary gown is then put on, and the knees and ankles are fastened together. The wrists are also fastened and a tag is attached to them containing the patient's name, the ward, and the date. When the toilet is complete, the body is wrapped in a sheet or shroud. A tag is attached to the outside bearing the same information as that on the inside. A stretcher is prepared and the body is lifted gently and reverently to it. It must be completely covered and securely fastened to the stretcher. The removal of the body from the ward to the morgue should be conducted with all seemly respect and dignity. As far as possible all the details of the death, after-care, and removal should be spared the other patients.

Before the screen is removed soiled articles, bed linen, etc., should be removed; the chair, bedside table, and bed should be cleansed and the bed should be remade. There should be nothing left to suggest the death of a patient.

All clothing, and other personal property of the patient, should be listed, wrapped neatly in a bundle, properly tagged, and taken to the main office.

PART II

NURSING IN THE PREVENTION AND CURE OF DISEASE (Continued)

NURSING THE ACUTELY ILL

CHAPTER XX

INTRODUCTION

LESIONS OR PATHOLOGICAL CHANGES TO BE PREVENTED OR CURED

Inflammation and Congestion

The treatments and nursing care discussed in the following as well as in previous chapters for the cure of disease are all given to modify, either by stimulation or retardation, some lesion in the body. Such lesions, from a pathological standpoint, may be classified under two headings, as follows:

1. Inflammation and Congestion.
2. Neoplasms or New Growths.—The treatment of growths falls almost wholly in the realm of surgery (including the use of x-ray and radium therapy) with the two following important exceptions which fall also in the realm of nursing: (a) The knowledge and early recognition of the symptoms of new growths; and, without alarming the patient, the responsibility of advising and helping her to secure the prompt attention of a physician; (b) The care of the patient before and after an operation, if performed. The latter has been discussed in Chapter XVIII and in Part II-B.

The treatments, therefore, with which we are concerned are used largely, if not wholly, to relieve inflammation and congestion. For this reason it is essential to have a thorough understanding of an inflammatory process which is the lesion present in nearly all diseases which occur in the body. Only with this understanding can we intelligently, and with safety, apply the treatments prescribed, or know when we are getting the desired results (and if not, why not), or recognize the symptoms which indicate that the treatment is, perhaps, actually doing the patient harm.

What Inflammation Is.—Inflammation is a name given to a process consisting of a series of circulatory and exudatory changes which occur in response to an injury to tissue cells, and which vary in degree according to the host, and the nature, extent, and location of the injury.

We are all familiar with an inflammatory process in the form of cuts or bruises, styes or boils, burns or frost-bites, toothache or earache, "sore throat" and the "common cold in the head." Many of us are, and all will become familiar with more deep-seated and more serious inflammatory processes in the form of such diseases as pneumonia, pleurisy, typhoid fever, tuberculosis, nephritis, pericarditis, rheumatism, and many others. Each and all of these represent the *local attempt made by the tissues in self-defense against an injury,* which results in the lesion called *inflammation.*

Perhaps most of us, because of the discomfort involved or the results of an unsuccessful defense, have thought, and indeed have been taught to think, of inflammation as a "morbid process"—an evil to be checked by every possible means. Whereas, it is now recognized, as a fundamental biological law, that *injury to body tissues,* whatever the cause and whatever the injury, acts as a *stimulus;* and that the tissues *respond* to this stimulus in a characteristic way, inherent in the tissues themselves, which gives rise to a series of reactions or changes spoken of, because of the symptoms presented, as an *inflammatory process.* One eminent author has described it as "the immediate protective and defensive reaction to an injury"—"a purposeful and beneficial reaction." As self-preservation is one of the primary tendencies in all living things we may think of an inflammatory process as the local attempt of the tissues to destroy the injurious agent, to prevent further injury, and to remove the products of the struggle so that repair or reconstruction may take place.

Causes of Inflammation, or Agents which may Produce the Stimulus.—This injury, or death of tissue cells, may be caused by various agents such as the following:

1. *Physical Agents.*

(*a*) *Heat, electricity,* or the *sun's rays* which may cause burns of varying degrees.

(*b*) *Cold* which may cause chilblains, frozen tissues, or frostbites.

2. *Mechanical Agents.*

(a) *Foreign bodies* such as slivers, metals, bullets, and needles which may be carried into the tissues. Sutures left in the tissues, if not absorbed, act as foreign bodies. Gauze left in a wound as packing, dead tissue cells, or dead bone act as foreign bodies. Food or secretions carried into the lungs act as foreign bodies, and may set up a "foreign body pneumonia," or a septic abscess. Pins, coins, seeds, or pebbles, etc., may be carried into the respiratory or the alimentary tract; and children sometimes poke seeds, pebbles or other round objects into their nose or ears where they may remain and cause inflammation.

(b) *Friction,* as from the irritation of a collar or other clothing; restlessness in bed; two body surfaces in contact, together with heat and moisture, as in fleshy people, and with improper bandaging; and blisters, corns, or bunions from the friction of shoes.

(c) *Pressure,* as from the weight of the body on the bed, which shuts off the circulation and causes bedsores (decubitus ulcers); a tight bandage, cast, or splint which interferes with the circulation. Any interference with the circulation to a part, and any interruption of the nerve supply, either from pressure, or injury to the spinal cord, with resulting paralysis, may result in the death of skin and tissue with ulcer formation. Pressure from direct violence or trauma may result in bruises, cuts, wounds, fractures, dislocations, sprains, or the rupture of an internal organ, all of which are accompanied by inflammation.

3. *Chemical Agents.*

(a) *Acids,* as in an "acid mouth," causing sore gums and decayed teeth; acid urine or stools, causing sore buttocks; hyperacidity in the stomach.

(b) *Alkalies,* as in decomposing urine which liberates ammonia and causes sore buttocks; lime in the eyes, or swallowed by mistake, which causes burns and ulceration.

(c) *Disinfecting solutions,* such as bichlorid of mercury, Dakin's solution, or iodin.

(d) *Counterirritants,* such as mustard and turpentine.

(e) An *exudate,* from a discharging ear or wound, which may cause irritation, eczema, or ulceration of the skin.

(f) *Poison* from plants or animals, and toxic substances from bacteria or dead cells.

4. *Bacteria.*

All pathogenic microörganisms and dead disintegrating cells produce toxins which act in the same way as chemical poisons. In diphtheria, the bacteria do not penetrate beyond the throat but the toxins they produce are absorbed and may cause death. In pneumonia, the bacteria are chiefly in the lungs, but the toxins produced by them and absorbed may so poison and weaken the heart that the patient may die, not from the injury to the lungs but from heart failure. After childbirth or after an abortion, should a portion of the placenta remain in the uterus, the patient may die from a general blood poisoning (sapremia) because the tissue, receiving no blood supply, will die, disintegrate, and form toxic products which will be absorbed into the blood stream. Many similar examples might be given.

The most important factor to note about these agents is, perhaps, their *solubility* or *insolubility* because of its relation to the nature and possible extent of the injury.

Insoluble agents, such as certain foreign bodies, may, by their mere presence, cause more or less *local* injury to the tissue cells, nerves, blood vessels, and other structures; sharp bodies, such as needles, may rupture a blood vessel. But insoluble agents are inert; they do not enter into chemical combination with cells. While their position may be altered by the pressure and contraction of surrounding tissues, they do not diffuse through the tissues or intercellular spaces and cannot be absorbed into the lymph or blood stream. They do not ingest and digest, or give off toxic substances or poisonous excretions. They do not alter the ionic properties of fluid in tissue spaces, thus affecting tissue metabolism, by producing an acid or alkaline medium. They do not injure remote body tissues or produce (directly) any systemic effect. Their effect is purely local.

Soluble agents, while they may do little harm, may, on the other hand, do all of these things. Catgut, an organic substance, will be dissolved in the tissue juices, absorbed into the lymph or blood stream and do little, if any, harm. Chemicals, on the other hand, by their power to diffuse, to combine with tissues, to change the reaction of fluids, and to be absorbed, may cause both serious local and general damage. Dead bacteria and dead disintegrating tissue cells may, as already explained, cause serious systemic injury. Living bacteria sometimes appear to set up a relationship with the tissues and, under certain conditions, as in the intestines, nose, mouth, and throat, do no apparent harm. But as living active agents, when no such relationship exists or when broken down, pathogenic organisms ingest, digest, excrete, breathe, reproduce, struggle for an existence, produce toxic substances, injure and kill tissue cells, are themselves killed, and so may cause both local and systemic effects.

Body Defenses Against Injury.—It is interesting and wonderful to note how, in the course of ages, the body has inherited or acquired various means of defending itself against injury until we find at each point some mechanical or chemical guard; and to note, also, how inflammation takes its place, so to speak, in the second line of defense. Our first line of defense is made up of guards so familiar, so prompt, and sometimes so forceful as to appear, as it were, indignant; and so automatic and perfect in their response to injury, that we sometimes, as in vomiting, think of the remedy as the disease and fail to appreciate the service rendered. These factors of safety may be considered as forming the following three lines of defense:

1. *Guards in the First Line of Defense.*—The respiratory tract expels injurious substances by sneezing or coughing; the stomach by vomiting; the intestines by diarrhea; the eyes by tears and blinking. The pupils of the eyes contract to keep out light. The skeletal muscles contract and we shiver and shake to make heat when we are cold. The abdominal muscles contract and we bend over to ward off an expected blow on the abdomen in order to protect the more vital organs. Many other examples of the instinctive contraction of muscles to expel injurious substances or to ward off injury might be given. In addition to these defenses, the impervious skin, enforced by hair and nails, the cilia of various linings, the perspiration, gastric juice, bile, and other secretions all play their part in the first line of defense against injury.

2. *Guards in the Second Line of Defense.*—An *Inflammatory Process.*—But in spite of this marvelous system of protection, the body is still exposed to injury, and the portals are constantly besieged by an army of bacteria ready to destroy the tissues should the first line of defense break down. Should this happen, and a few cells be killed by a physical, mechanical, or

chemical agent, or by bacteria, the challenge will be met immediately by our second line of defense—an inflammatory process or the local reaction of the tissues to injury.

3. *Guards in the Third Line of Defense.*—These are the phagocytes and subtle invisible materials in the blood, the character of which is not understood but which, because of the evidence of their presence and of their supposed function, are called opsonins, bacteriolysins, cytolysins, and autolysins. All these substances, in addition to the other factors mentioned, are normally present and functioning in the body, and, in response to a stimulus, may be greatly increased in number and in activity.

The Nature of an Inflammatory Process

The response of tissues stimulated by an injury, by a fundamental biological law, is characterized by the following aspects or steps:

1. A vascular response at the zone.
2. An exudation response at the zone.
3. Proliferation of tissue cells around the injured zone—a healing, reparative process.

These reactions do not occur separately but overlap one another. They vary in degree; sometimes one phase is more marked, sometimes another, but all are in some degree present.

Vascular Response to Stimuli

1. More Blood to the Part.—Symptoms Observed.—We have all seen in others, or have been conscious, ourselves, of blushing, brought about by a sudden thought, word, or look. The blood vessels in the skin dilate, more and more rich warm blood flows quickly through them giving a beautiful glow to the cheeks, and we say: "My face just burned." We know there are other causes, such as the heat rays of the sun, the sting of a cold, bracing wind, or of a sharp blow, which bring the same rich glow to the skin. We have all, perhaps, experienced the discomfort which results from a simple congestion or increase of blood in the vessels of one part of the body or another—as, for instance, a headache caused by too much blood in the head, or a feeling of "stuffiness" in the head caused by congestion of blood in the nose which warns us that we are getting a "cold in the head." Another familiar example is the dicomfort which sometimes occurs a day or two before the menstrual period. This discomfort is due to the pressure on nerves caused by the congestion which normally precedes the menstrual flow. Now this is exactly what happens in any part of the body when tissue cells are irritated or killed.

In order to understand this step as beneficial and protective, it is necessary to remember that the growth and function, the very existence of every little cell in the body, depend upon a constant supply of nourishing, life-giving blood, and an equally prompt and constant removal of the waste products resulting from its activities. At some times this need is more urgent than at others. When cells are injured, the need of a free circulation will be still greater because the damaged cells must have heat, food, and oxygen to rebuild and restore them, and because there will be more waste products to remove. Nature's *first response* is, therefore, to send *an increased supply of blood* to injured cells.

2. **Congestion.—Symptoms Observed.**—The blood vessels of the injured and adjoining parts become greatly dilated, the increased volume of fresh, rich blood, the great healer, flows rapidly through them so that small vessels, invisible before, are distended giving to the part a uniform reddish glow. Thus we see the *first cardinal symptom* of inflammation—*redness*. The velocity of the flow is increased and the packed red cells may be seen bumping along in the stream. The warm blood flows

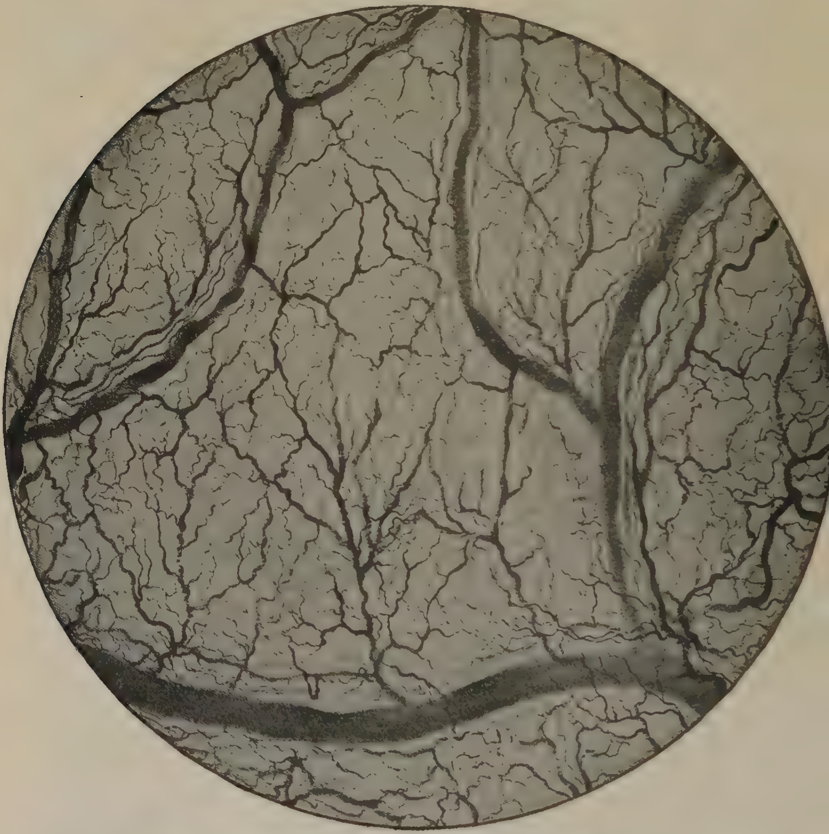

Fig. 103.—Portion of Inflamed Diaphragm to Show the Abundant Dilated Blood-channels. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

so rapidly through the distended vessels that it has not time to cool off as it usually does in superficial vessels, so we have the *second cardinal symptom* of inflammation—*heat.* (Little of the heat is thought to be due to increased metabolism in the part). The relaxed blood vessels offer little resistance to the blood so, if we were now to watch the stream through a microscope, we would see a homogeneous fluid with the red and white blood cells carried along, like a core in the center of the stream, by the rapidity of the current.

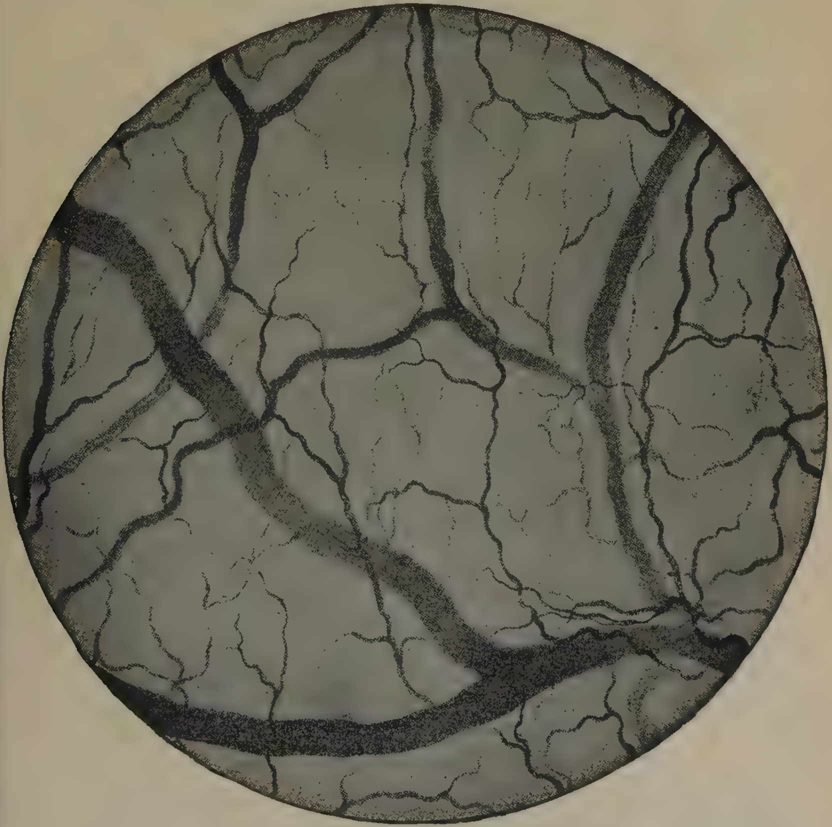

FIG. 104.—PORTION OF A NORMAL DIAPHRAGM TO SHOW THE RELATIVELY FEW VISIBLE BLOOD-CHANNELS. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

EXUDATION RESPONSE TO STIMULI, AND SYMPTOMS OBSERVED

This increased volume and velocity of blood in the part causes the vessels to be so engorged that there is more blood than can be promptly carried away or easily contained in the capillaries and small blood vessels; fluid, white cells, red cells, and other materials pass out into the tissue spaces.

1. **Passage of White Cells.**—As we continue to watch the stream, very soon we see that, although the vessels remain dilated, more resistance seems to be made to the flow of blood and the stream slows down. (The nature of this resistance is not understood, but is thought to be some change in the endothelial lining of the blood vessels.) With the slowing of the stream, white cells, by their own weight, are carried to the sides of the vessels and, in the venules, are seen rolling along close to the walls, then adhering to them, and finally, by active ameboid movements, passing through to wander in the "thickets" of the tissues. Here they are called wandering cells and are chiefly of the polymorphonuclear type.

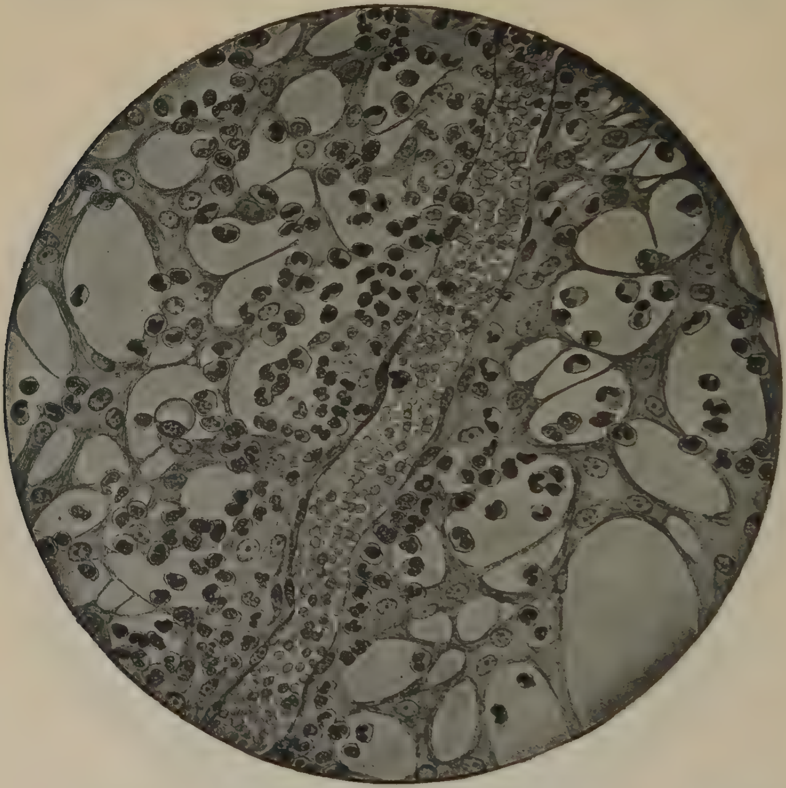

Fig. 105.—Inflamed Omentum Showing Outwandered Leucocytes About a Small Vessel. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

These white blood cells, you will remember, have two important functions because of which they are often called the *scavengers,* and *soldiers* or *phagocytes* (from *phago,* to eat, and *kytos,* a cell) of the body. They travel out from the blood stream into the tissues and pick up dead cells, bacteria, and other foreign matter, and either devour and destroy them (or are themselves destroyed in the process), or carry them back through the lymph stream to the blood stream and to organs in the body where they can be destroyed and eliminated. This active migration of leucocytes is thought to be due to a process called *chemiotaxis* meaning "the stimulation to motion by a chemical substance." In this case the substance is probably the toxin or soluble injurious agent itself, or the poisonous products from the dead disintegrating cells.

2. Passage of Red Cells and Platelets.—Red cells in varying numbers are also found outside the vessels. How they get out is unknown. It is thought that they have no power of motion but they are compressible and may, from pressure within the vessel, passively follow the leucocytes, a process called *diapedesis.* The passage, as observed under the microscope under normal conditions, is extremely slow, taking a period of hours. It has been described as follows: The wall of the capillary in a certain area is bellowed out, forming a sac; the sac breaks and cells are outside the vessel; the sac collapses and closes, and the edges stick together. This very slow process does not account for the large number seen in an inflammatory process; but it is supposed that the injury to the tissues at the time injured and ruptured many small blood vessels, allowing the escape of cells. A large number is, therefore, significant, indicating that many vessels have been damaged. The number is also significant because indicative of the type of injury as seen in the exudate of pulmonary tuberculosis, and of malignant growths. The function of red cells, as far as known, is merely to carry oxygen. They are soon destroyed (indicated by the discoloration of the part) because delicate, sensitive to the environment, and only at home in the circulation where the ionic

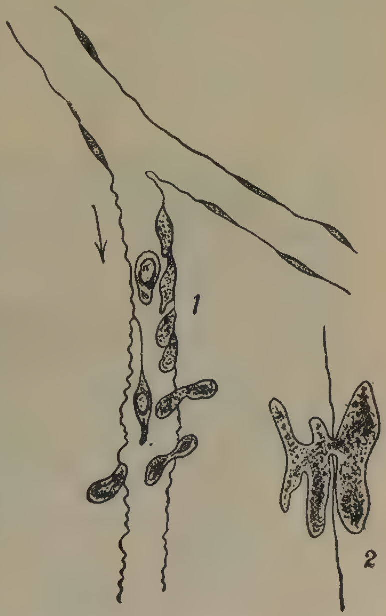

Fig. 106.—1, Adhesions of Leucocytes to the Walls of a Capillary in an Inflamed Area; 2, Mode of Migration of a Polynuclear Leucocyte (Lavdowsky). (From Adami's "Principles of Pathology," Vol. 1, Lea and Febiger, Publishers.)

properties are favorable. Outside they swell or shrink, clutter up the zone, and are picked up and carried away by the white blood cells.

3. Passage of Fluid into the Tissues, and Symptoms Observed.—At the same time, and probably before the passage of cells, fluid oozes out into the tissues; the lymphatics and lymph spaces, before invisible, are now seen engorged with fluid (edema) distending the tissues, crowding the cells, and causing pressure on the sensitive nerve endings. Thus we see the *third cardinal symptom—swelling,* and the *fourth symptom—pain.* (Pain may be due, also, to direct injury to nerves when tissues are injured.)

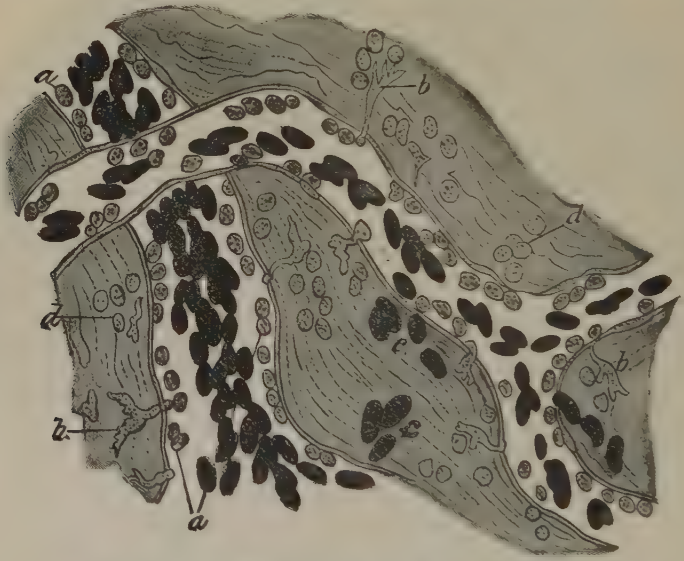

Fig. 107.—Inflamed Mesentery of Frog: *a,* Margination of Leucocytes in the Dilated Capillaries; *b,* Migration of Leucocytes; *c,* Escape of Red Corpuscles; *d,* Accumulation of Leucocytes Outside the Capillaries (after Ribbert). (From Adami's "Principles of Pathology," Lea and Febiger, Publishers.)

The injury, swelling, and pain, and, more important, Nature's effort to avoid increasing irritation and pain by movement, together cause the *fifth symptom—loss of function.* This loss of function, although a matter of inconvenience, may not be very serious if it merely involves a finger or even the temporary loss of the use of a hand; but it may be a matter of great seriousness if it involves a vital organ such as the heart or lungs. For instance, if it involves the lung, as in pneumonia, it may not only interfere with the supply of oxygen to the entire body, but the bacterial toxins absorbed will poison the nervous system and the heart, so that every organ in the body will suffer; if it involves the heart, not only the oxygen supply but the supply of food, the distribution of heat, and the removal of wastes will be interfered with; if the kidneys, the chief means of eliminating waste; if the skin, as in extensive burns, the chief means of eliminating excess heat, as in all the conditions mentioned, will be interfered with.

This fluid varies in amount—it may be small or great, and the amount may or may not indicate the severity of the condition. Its constituents vary in amount and in proportion, and these variations are significant. It is not the same as blood plasma nor is it the same as lymph. It will contain blood cells varying in number and types, and much or little protein, fat, inorganic salts, opsonins, and immune bodies. It may be hypo-, hyper-, or isotonic. It may be more or less acid or alkaline and its specific gravity varies with the amount of ingredients present. Because of the significance of these variations in relation to the diseases in which fluid is present, clinicians have attempted to classify the fluid as either a *transudate* (low specific gravity), or an *exudate* (high specific gravity). (See page 389.) One constant factor, always present, is the capacity of clotting which indicates the presence of materials necessary for the formation of fibrin in greater or lesser amounts. (See textbook on anatomy and physiology for clotting.)

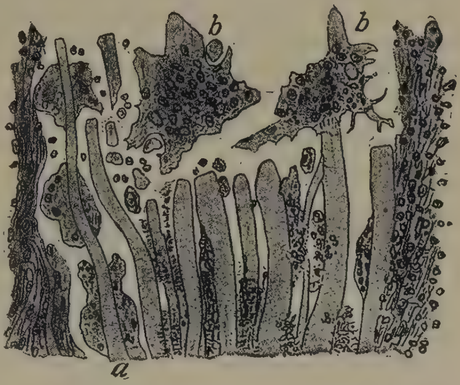

Fig. 108.—Foreign-body Giant Cells from Man; at *a*, The Leucocytes Form Around Foreign Fibres (Silk); at *b*, The Giant Cells Have Broken Away Containing Débris of the Fibres (Ribbert). (From Adami's "Principles of Pathology," Lea and Febiger, Publishers.)

The way in which fluid passes out is in accordance with the principles governing the properties of living membranes, but these are not entirely understood. For a possible explanation see page 600. The purpose of the fluid is not entirely known because its chemical properties are not sufficiently understood. It is probably to dilute, to dissolve, to mechanically wash away and carry wastes into the blood and lymph streams. The inorganic salts present in a hypertonic solution may act as an irritant and so draw more fluid to dilute and wash away.

Clinical Picture.—Summary of Symptoms.—The area will be now more or less red, hot, swollen, painful and angry looking, and there will be more or less loss of function according to the nature, extent and location of the injury, and the vitality and resistance of the cells. *Heat, redness, swelling, pain* form the group of symptoms and the clinical picture to which Hippocrates gave the name *inflammation;* the fifth symptom, *loss of function,* was added later.

4. **Termination of the Process by Resolution.**—If the injury or stimulus has been slight; for instance, if only a few cells have been killed by a cut with a sterile instrument, fluid which oozes out from blood vessels will glue the sides together. Leucocytes, acting as scavengers, will carry away the dead cells, or digestive ferments in the fluid or from the disintegrating dead cells themselves by autolysis or self-digestion will liquefy the dead tissue which will then be absorbed by the lymphatics to be later eliminated in the urine. The field is thus cleared of débris, and the second stage of the slight inflammatory reaction is ended. The now unhampered cells are ready to begin the *third stage,* that is, the *proliferation of cells.*

If the injury be more serious, as in a severe burn in which blisters are formed and many tissue cells are destroyed, the inflammatory process and all the symptoms arising from it will be much more marked. If the blisters are not broken the fluid contained in them will soon disappear by reabsorption into the lymph or blood stream. Where the cells have been destroyed an inflammatory exudate of serum, fibrin, white and red cells will surround the injured tissue and form, so to speak, a safety zone between the healthy and injured tissue which it will gradually permeate. Digestive ferments will then digest and liquefy the dead tissue so that it can be carried away by absorption into the lymphatics or by the scavengers. In this way all the débris is removed and the "housecleaning" is completed. When this takes place the inflammatory process is said to end by *resolution.* (When this takes place, for instance, in the lung, the tissue is said to be resolving.) The area is now ready for the third stage of the process.

5. **Formation of a Slough and Ulcer Formation.**—Sometimes, however, the injury to the tissues may be so severe, or the wounded area so extensive (as in a very extensive bruise or burn), and the circulation so interfered with that the damaged tissues can neither be revitalized nor carried away fast enough, unaided, by resolution. The tissues will then gradually die and form a slough (a mass of dead tissue in living tissue) which will by degrees separate from the living tissues and "slough away" leaving an *ulcer* which must be filled in by the formation of new tissue. The more quickly the slough is separated and removed the more prompt the repair, so applications are sometimes applied to hasten it.

6. **Termination of the Process by Suppuration.—Pus Formation.**—When the injury is due to an attack by bacteria we have a different picture: for we have living active organisms on both sides opposed to each other and struggling for an existence. Suppose, for instance, that a hair follicle in the skin on the back of your neck has become clogged with dirt so that the outlet for its

products has been shut off; and suppose that this area has been further irritated by a stiff frayed collar, then tissue cells will be damaged and a slight inflammatory reaction will occur. The balance of adjustment, normally present between the staphylococcus albus and the skin, will then be broken down and bacteria, which cannot enter through an unbroken skin, will eagerly seize just such an opening, will enter the damaged tissues and cause further havoc. We then have a battle; on the one side we have bacteria which may multiply rapidly, on the other, tissue cells which probably do not. The attack and defense may be a mere borderline skirmish (the tissue cells, serum, fibrin, leucocytes, etc., of the exudate on the one side, bacteria on the other) in which the leucocytes valiantly rout the enemy by swallowing and digesting them. (See page 337.) In this case a few white cells may be killed in the struggle; ferments from the serum and from dead leucocytes, bacteria, and tissue cells may cause liquefaction; absorption follows and the battle is over.

If the bacteria are very virulent or attack in great numbers (or if the tissues are weak) they will advance, killing as they go so that they soon become entrenched or surrounded by a devastated area on which it is difficult for living things to exist. The bacteria may further strengthen their stronghold by giving off toxins, a sort of "poison gas" which kills whatever may dare to approach. However, the tissues, undaunted, immediately set about their defense. The inflammatory exudate forms a trench, so to speak, of serum and fibrin in which are many soldiers (leucocytes) around the position taken up by the enemy. The soldiers go "over the top," many of them being killed in the attempt, but fresh relays, attracted to the spot (chemiotaxis) keep constantly coming up and finally succeed in dislodging and destroying the enemy (phagocytosis). In the meantime, around the margin, serum and fibrin permeate the dead tissue, ferments from dead leucocytes and cells gradually liquefy it, forming a zone of thick, yellowish fluid (pus) around a hard center or "core." This is what happens in the formation of a boil. Finally, the whole mass is liquefied, forming a circumscribed collection of pus or *abscess.* Where this occurs the inflammatory process is said to end by *suppuration;* that is, by the formation of a purulent exudate or pus consisting of serum, fibrin, partly disintegrated leucocytes and tissue cells and any bacteria which may have survived. Some of the exudate and toxins will be absorbed into the lymph stream by resolution or the abscess, if superficial, may rupture on the body surface; in a boil, it may rupture the skin; in the lung, some of it will be coughed up. If the abscess is deep it may form a tract or *sinus* to the surface, or it may have to be incised and the fluid withdrawn by drainage or aspiration. The pressure caused by the accumulated débris and the gases formed by the bacteria help to form an outlet of discharge for the pus or may cause it to spread by pushing out along the lines of least resistance and so cause *cellulitis.* Bacteria and their toxins absorbed into the blood stream may cause *septicemia, pyemia, toxemia,* and death. We must always bear in mind that pus may contain bacteria, which, after developing in such a suitable medium as the body tissues, will probably have greatly increased their virulence, so that if allowed to enter our tissues through the most minute abrasions on our skin may cause septicemia and death.

The extent of this local reaction is not wholly dependent upon the nature or extent of the injury; nor is the general severity of the resulting disease always proportionate to the local anatomical changes in the tissues. For instance, the *tetanus* bacillus causes little local change but the diffusible toxin produced seriously injures nerve tissue and usually results in death. The pneumococcus may cause little local damage to the lung and the area involved may not be great but the exudate may be large and the toxins produced may cause death.

7. Terms Used to Describe Exudates.—All inflammatory exudates caused by bacteria are not purulent. As stated previously, the constituents of exudates vary in proportion, and these variations are significant. Because of this significance, from a diagnostic and prognostic standpoint, physicians have given names to exudates which indicate their chief characteristics. For instance, inflammation of *mucous membranes,* such as that lining the nose, ear, stomach, or vagina, is called *catarrhal inflammation* and the exudate a *mucoid* or *catarrhal exudate.* In inflammation of *serous membranes,* as in peritonitis, pleurisy, or pericarditis, the exudate may be *serous, fibrinous,* or *purulent.* In the painful dry pericarditis or dry pleurisy, the exudate is fibrinous and may cause the visceral and parietal layers to adhere and later become altered to form permanent *fibrous adhesions.* This will greatly interfere with the action of the heart or lungs. In empyema, an abscess of the pleural cavity, the exudate is purulent and is walled off by dense, fibrous adhesions. In post-mortem examinations, pleural adhesions are very commonly found. This same process occurs in the serous membrane lining the abdominal cavity and covering the intestines and other internal organs; so we frequently hear of the formation of adhesions following an operation, which, in turn, require a second operation to break down these adhesions because they interfere with the function of the intestines. In chronic appendicitis, with later abscess formation, the abscess will be found walled off and localized by adhesions formed by the peritoneum. All such adhesions are the result of inflammatory processes varying in accordance with the vitality of the tissues and of the host. Nature's object is to localize the disease, to wall it off, to build up a strong fortified barricade around it to prevent the disease from spreading or doing further damage.

We see, therefore, that the inflammatory process aims to keep the injured part supplied with healing, fortified blood and to keep it constantly moving through the part so that after the battle is over, and even while it is raging, the débris may be carried away. Sometimes the blood is not kept moving, then there is *congestion.* Sometimes, too, Nature goes too far, for it is possible to have too much even of a good thing.

We may with justice, then, grant that an inflammatory process, while involving much discomfort is a "purposeful, beneficial reaction"—compared, in some of its aspects, by Dr. W. G. MacCallum,[1] to a "housecleaning," usually a painful experience.

When this second stage, terminated by resolution or by suppuration, is over, and probably even while it is in process, the third stage of the process begins.

Repair or Healing by Proliferation of Cells

The reparative process will depend upon the nature, extent, and location of the injury and the types of cells injured. It will also depend upon the age of the tissue injured and the age and vitality of the host. Healing may take place either by *primary* or by *secondary* union.

1. Healing by Direct or Primary Union.—"First Intention." —When an injury is slight, as described on page 340, the unhampered living cells will quickly bridge the gap by the formation of new cells. The wound made in a surgical operation, if infection does not already exist, is an aseptic incised wound, that is, it is made by a sterile, sharp, cutting instrument and the tissues are sharply divided without tearing or laceration. When the edges of such a wound are brought together, nicely adjusted without puckering, and held together by sutures, wound clips or strips of sterile adhesive, etc., then covered with a sterile dressing so applied, protected and sealed as to exclude all possibility of the entrance of bacteria, it should heal by *direct* or *primary union* or by *first intention.* Healing by first intention means that the cut edges grow together or heal with the slightest inflammatory reaction and with the least requirement for the formation of new tissues. This occurs because merely the cells in the direct line of the injury are destroyed. Bleeding occurs between the cut edges and a small amount of blood may remain and form a clot. The blood supply will be increased and a small amount of coagulable fluid will ooze out. This also clots and glues the edges together. Epithelial cells and connective tissue cells divide and form new cells to replace the injured cells. The endothelial cells of the walls of the capillaries sprout or send out bud-like processes which stretch across and join similar sprouts from the other side. Endothelial cells divide, forming new cells, and the pressure of blood hollows them out into tubes. In this way new blood vessels are formed and the circulation is established. Leucocytes remove the few dead cells. Later a small amount of new connective tissue is produced which forms a scar, in this case almost or quite imperceptible.

2. Healing by Indirect Union or the Formation of Granula-

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[1] A Textbook of Pathology.

tion Tissue.—When, from any cause, the edges of a wound cannot be brought together so that a gap remains between them which must be filled in by the formation of a considerable amount of new tissue (granulation tissue), repair is said to take place by *indirect union.* The repair may be a sort of patchwork, sometimes even quite unsightly, and without restoring the function of the part, because several kinds of tissues may be injured and tissues vary greatly in their power to regenerate themselves. The epidermis and connective tissues are only slightly specialized and so regenerate rapidly. The central nervous system, the muscle of the heart and blood vessels, and all striated muscles are highly specialized and regenerate themselves hardly at all so that any gap made in these tissues must be filled in by inferior tissue which can grow fast and restore the continuity although not the function. The universal tissue used for patching is the fibrous connective tissue which is strong but not so elastic or so well supplied with blood vessels. This is why inflammation or injury to the tissues of the brain, the walls of the heart or blood vessels, and of other internal organs, is so serious. In the brain even this repair cannot be made because there is so little of this connective tissue there: A wall merely is formed around the diseased part so that, as it is carried away, a space is left which is gradually filled in with fluid, forming a cyst.

The degree of the protective inflammatory reaction which follows depends upon the injury and whether or not infection is present. Immediately the surface of the wound or cavity is covered by a thin layer of fibrinous exudate. This thin fibrin forms a valuable protection as it has been found that, while bacteria are absorbed within a very short time by lymph and blood vessels from fresh bleeding wounds, as soon as this coagulum has been formed, bacteria are no longer quickly carried into the blood and lymph circulation. It also helps to check bleeding, which, in addition, is checked by the clotting of the blood and the contraction of the blood vessels. The exposed surface tends to contract with the formation of this coagulum and this aids in closing the wound and in bringing the edges together.

As the inflammatory process sets in, with an increased supply of blood, fluid and white blood cells are poured out which coagulate, forming a network of fibrin. This fibrin acts as a support or guide for the connective tissue cells which stretch out by ameboid movements along it. Sprouts of endothelial cells from the capillaries also stretch out into the network of fibrin and as new endothelial cells are formed, they are spread into tubes by the pressure of blood. Connective-tissue cells divide and grow out along the fibrin and surround and support the new capillaries. Capillaries anastomose or join other capillaries, forming tiny arches which form little pinkish elevations, giving the surface an uneven, granular, velvety appearance. This all takes place very rapidly so that the advance can be watched from day to day.

This *granulation tissue*, then, consists of abundant blood vessels and young connective-tissue cells spread apart by fluid and fibrin. When healthy it is soft gray or grayish-red, gelatinous, and translucent, with an irregular, velvety surface, bleeding at a touch, but quite insensitive to pain because containing no nerves. Although the surface of a healthy granulating wound offers great resistance to bacterial invasion, this resistance may be broken down by very slight injuries, such as probing, the removing or the shifting of a dressing, etc. The skin edges also tend to turn inward and may act as a wick carrying in infection.

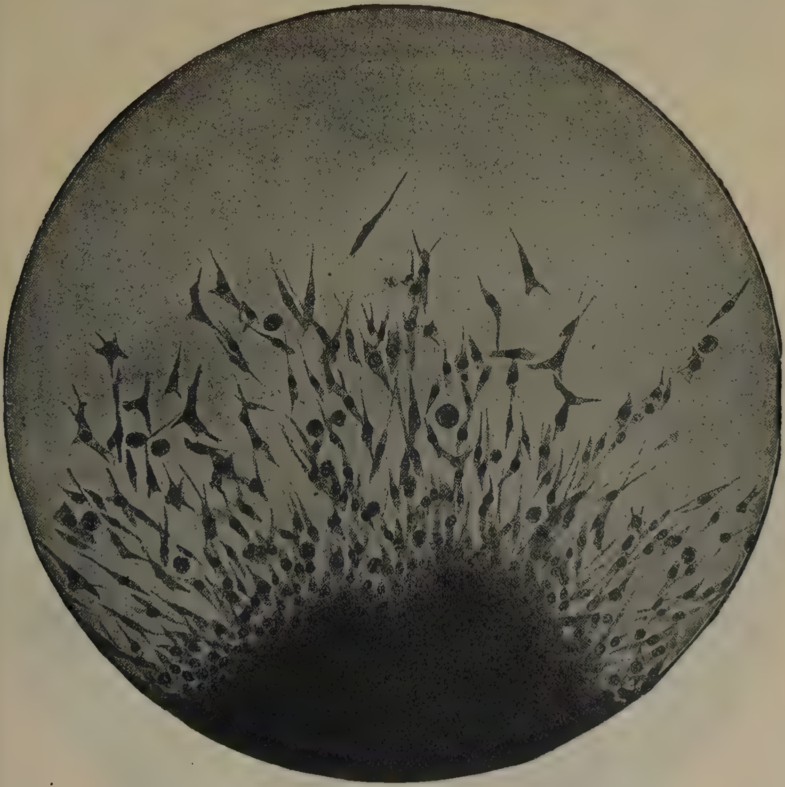

Fig. 109.—Characteristic Growth of Connective Tissue Cultivated in Vitro. There are many mitotic figures. (From MacCallum's "Text-book of Pathology," W. B. Saunders Co., Publishers.)

Sometimes healing is delayed or *indolent*—the tissue is then pale, dry, shrunken, flabby and unhealthy looking. Sometimes it grows too fast. It is then said to be *redundant* and is soft, large and bleeds easily. The granulations should form from the bottom and sides of the wound, filling in the gap evenly until even with the surface. Sometimes it grows above the surface and must be removed with caustics, or sometimes there is a tendency to grow faster and therefore close in at the top first. This is prevented by putting in drainage to keep it open. When the gap is nearly filled a thin grayish blue film of epithelium may be seen spreading out from the edges to cover the surface "much as ice in its first formation spreads out from the edges of a pond." The epithelial cells behind divide, multiply and push the others forward until finally the surface is covered. It is at first bluish but later white. The specialized structures such as secreting glands and hair, etc., are not formed. When a wound is extensive or the formation of the new epithelium is slow, frequently a "skin graft" is made.

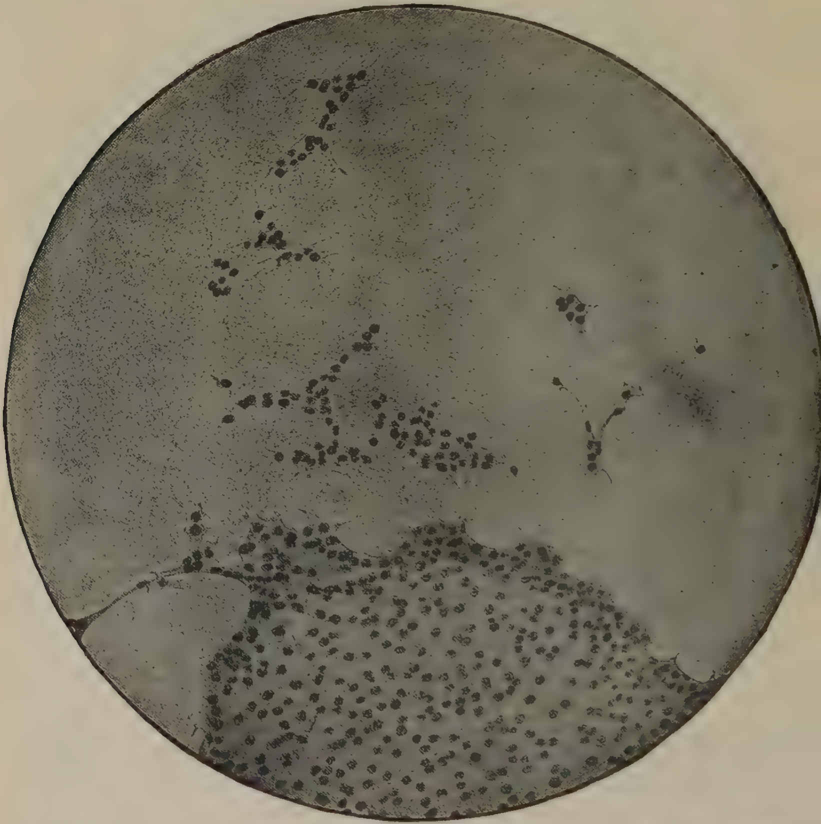

FIG. 110.—CHARACTERISTIC GROWTH OF EPITHELIUM IN CULTURE. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

Connective tissue, then, covered by epithelial tissue forms the bulk of the new material used for repair. At first the tissue looks purplish under the pearly epithelium because of the abundant blood vessels—this is particularly marked on exertion, which increases the blood supply. As the connective tissue is completed many of the new blood vessels are pressed shut and disappear and the part becomes very white (because of the lack of specialized pigment cells) and hard; it is then called the *scar* or *cicatrix.* As the tissue is inelastic it causes a contraction of the part and, if extensive, as in a severe burn, is apt to cause *deformity* or, as in an extensive operation for the removal of the breast, *loss of function* of the arm. Later the contracted tissue stretches out somewhat, so that the deformity is lessened, and nerves again develop in it.

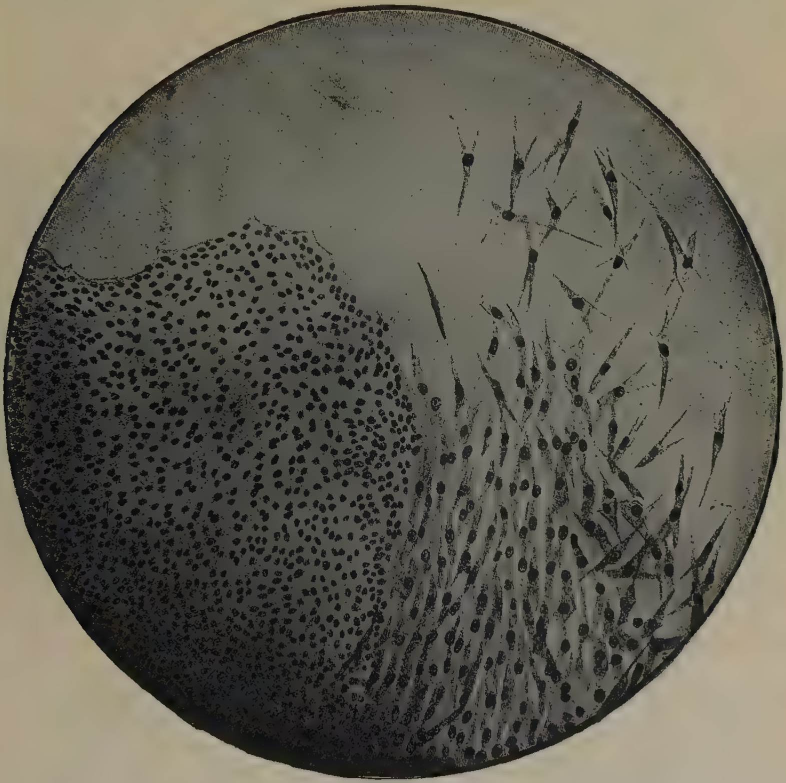

FIG. 111.—EPITHELIUM AND CONNECTIVE TISSUE GROWING SIDE BY SIDE IN A CULTURE MADE FROM THE INTESTINE OF AN EMBRYO. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

If healing takes place by either of the above methods without interference and no other complication arises, the patient's temperature should return to normal after the first two or three days and local tenderness should disappear. Immediately after the operation the temperature may be subnormal but as the reaction sets in it is elevated for the first few days and the pulse shows a corresponding elevation. If it remains elevated and the wound is very tender and sore, one should suspect infection with inflammation and possible suppuration.

An elevated temperature following an operation may be due to other causes besides the wound, such as pneumonia or auto-intoxication. Pneumonia will be discussed later. Auto-intoxication is due to the absorption of the products of fermentation and putrefaction of contents in the intestines. In this condition the temperature and other symptoms subside after the intestines are cleansed by an enema.

Complications Which May Occur in the Healing of Wounds.—(1) *Scar formation* with contraction resulting in deformity or loss of function. (2) *Keloid,* that is, an actual tumor formed in the surface of a scar due to the over-activity of the connective tissue. (3) *Ulcer formation,* that is, a raw surface caused by a more or less extensive necrosis of the skin or mucous membrane due to poor circulation, poor nutrition from interference with the nerve supply, lowered vitality, diseases such as diabetes or nephritis and other causes. (4) *Sinus formation,* that is, the formation of a channel, lined with a pyogenic membrane, extending from an abscess to the skin, mucous membrane or wound. The abscess may be due to bacteria or to sloughing or dead tissue such as a piece of dead bone (sequestrum), or it may be due to a ligature left in and not absorbed or a wipe or other foreign body accidentally left in the wound. Irritating bile or urine will also form a sinus. The channel will remain persistently open and will discharge until the foreign matter is removed. (5) *Fistula formation,* that is, an artificial channel which connects

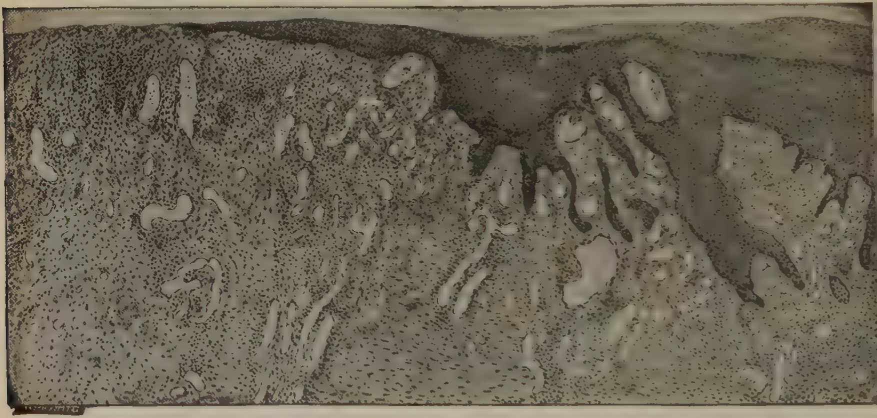

FIG. 112.—GROWTH OF EPITHELIUM OVER A GRANULATING SURFACE. Irregular downgrowths of epithelium are an index of the delay in the healing. (From MacCallum's "Textbook of Pathology," W. B. Saunders Co., Publishers.)

a gland, duct or hollow organ, either with the exterior or with another gland, duct, or hollow organ. The most common are the intestinal or fecal fistula, gall-bladder fistula, renal fistula and fistulæ of the urinary bladder. They are usually due to some obstruction to the normal passage of the contents of the organ, duct or gland.

Systemic Reaction to an Inflammatory Process.—Systemic Symptoms.—*Guards in the Third Line of Defense.*—With every intense inflammatory reaction, with the absorption of poisons from bacteria or dead cells, with the increased waste products to be eliminated, with interference in the circulation, one would expect to find more or less marked changes in other parts of the body—just as a whole nation may be prostrated by the results of a war. We say the patient is toxic; the temperature "goes up"; the nervous system may be poisoned, and the patient be in a stupor or delirium; the muscles of the heart and blood vessels may be poisoned and lose their tone, resulting in heart failure or venous congestion; the muscles of the intestines may lose their tone, resulting in distention; the kidneys may be irritated and overworked, resulting in nephritis, or bacteria may enter the blood stream causing septicemia.

This general attack on the body is met by a third line of defense. Some poisonous product absorbed seems to stimulate the bone-marrow to a marked over-production of white blood cells or phagocytes. The number circulating in the blood is then greatly increased, just as in war new recruits are drafted into an army. This increase in the white blood cells is called *leucocytosis,* which not only indicates the presence of inflammation in the body, but is an indication also of the degree of resistance being made by the body. In all diseases of an inflammatory nature, such as pneumonia and appendicitis, etc., the blood is frequently examined in order to find out the "white cell count," that is, the number of white cells, in order to judge the extent of the inflammation and the patient's reaction to it.

Need of Regulation in an Inflammatory Process.—As we have watched the process we have seen that there were points where Nature needed assistance in destroying the injurious agent, in preventing further injury, in removing the products of the struggle, in repairing the local damage, and in preventing and relieving injurious effects on other parts of the body. Treatments, therefore, are prescribed. They may be to increase or check the blood supply; to increase or check suppuration; to stimulate resolution, and to stimulate or sometimes to check the formation of new tissue, or it may be to combat injurious systemic effects resulting from the local process.

We are now ready to begin our study of the treatments which will assist Nature to destroy the injurious agent, to prevent further injury, to remove the products of the struggle, and to prevent or relieve the injurious effects on other parts of the body.

THE LOCAL AND SYSTEMIC TREATMENT OF INFLAMMATION

From the earliest ages people have been suffering from inflammation of various types and have been experimenting with many different kinds of remedies. Most of the remedies we use now were discovered hundreds and even thousands of years ago, but it is only within recent years that we have learned how they act and how they can be used most effectively. Even the simplest agents, like hot and cold water, may do harm unless used at the right stages in the process and applied in the right way. The nurse is responsible for most of these treatments and their value depends in a very large measure on her intelligent understanding of the condition which she is treating and her skill in applying the remedy.

We have seen that a local inflammatory process, even though slight, may give rise to systemic symptoms and serious diseases involving the whole body. The treatments studied then will be both local and general applications for either a local or systemic effect. (When conditions not of an inflammatory nature are relieved by these treatments, they will be included, for the sake of convenience, in the therapeutic applications.)

The following is an outline of the treatments used:

1. Rest—local and general.
2. Position and pressure—local and general.
3. Irritants and counterirritants—local and general.
    (a) Rubefacients or reddeners.
    (b) Vesicants or blisterers.
    (c) Escharotics or caustics.
4. Depletion—local and general.
    (a) Leeching.
    (b) Wet cupping.
    (c) Phlebotomy.
    (d) Puncture, incision, and drainage.
5. Cold applications—local and general.
6. Vaccines, sera, and drugs for a local or systemic effect. These are given chiefly for their constitutional effect.
7. Hygienic measures—diet, sunlight, etc.,—to build up health and vital resistance.

In the treatment of *medical diseases* the methods used for the relief of inflammation and congestion include rest, position, the application of counterirritants, local and general, the application of cold, local and general, depletion, the use of vaccines and sera, and such treatments as a chest aspiration, an abdominal aspiration, lumbar puncture, and phlebotomy, etc. These will be discussed under the nursing care in medical disease.

In the treatment of *surgical diseases* the methods used for the relief of inflammation and congestion are chiefly rest, position and local applications of either heat or cold. These have already been discussed, but should be reviewed when studying their use in the treatment of surgical diseases.

In the treatment of *diseases of the eye, ear, nose and throat,* the methods used for the relief of inflammation are chiefly local applications of either heat or cold and occasionally depletion by means of leeches. These should be reviewed when studying their special application to diseases of the eye, ear, nose and throat.

Rest, position, and the *simpler applications of heat* and *cold* have been discussed in Chapter XVI. We now come to certain other forms of treatment which, either because of the condition of the patient or the somewhat more complicated nature of the procedure, demand more experience, observation, knowledge and skill on the part of the nurse. These will be discussed in the following chapters.

PART II-A

NURSING IN THE PREVENTION AND CURE OF MEDICAL DISEASES

INTRODUCTORY

Opportunities for Serving and Learning.—All the factors previously discussed in nursing essentials, in the maintenance of health, in observation, and in prevention have, perhaps, their greatest significance in relation to medical diseases. In all these health and preventive aspects the rôle of the nurse is becoming increasingly important. And in the care of the sick there is, perhaps, no other field in which the comfort and recovery of the patient are so dependent upon good nursing and no other field which so challenges or puts a nurse more upon her mettle or which offers such scope for mastering the difficult art and science of nursing.

While great strides have been made in the prevention of disease, there are still diseases which no means known to the art of man can abort or shorten, but in which nursing care can do much to alleviate, to prevent complications, to shorten convalescence, and to promote future health. Some diseases, such as pneumonia and typhoid fever, are called the "nurses' patients," the doctor being "at hand only for general supervision." In the care of such diseases an eminent doctor has said that "a good nurse without any doctor is better than the best doctor without any nurse."

The recovery of the patient and the effects of the following treatments will depend to a very large extent upon the spirit, knowledge, intelligence and skill with which they are given.

It is because of this special opportunity to learn and serve, and to develop, by serving, special knowledge, special skills, and special qualities of character, so essential in nursing, that students are given experience in the care of patients suffering from medical diseases.

CHAPTER XXI

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY COUNTERIRRITATION

The Meaning of Counterirritation.—Irritants are remedies applied for a purely local effect. They act as stimuli, the purpose and first response to which is an increased supply of blood to the part. Counterirritants are "remedies which by irritation of the skin are intended to counter or check deeper-lying affections." The degrees of skin irritation which may be produced are indicated in the present and preceding chapters.

The Action of Counterirritants.—The treatment by counterirritation is very ancient. It was used in various forms centuries before the Christian era. It is probable that it was first used with the idea of driving out or drawing out evil spirits and making the body an unpleasant place for them. Although it is one of the oldest and is still one of the most widely used remedies, its action is not entirely understood. Certain facts, however, have been fairly definitely proved by experience and by physiological experiments, and these facts are very fully and clearly presented in textbooks on hydrotherapy by Dr. Baruch, Dr. Hinsdale, and Dr. Kellogg, and in a text on Pharmacology and Therapeutics by Dr. Bastedo, from which texts the following explanations are, for the most part, taken.

In order to understand the action of counterirritants it will be necessary to recall a few facts regarding the anatomy and physiology of those structures of the body through which the action is chiefly brought about. The structures are the circulatory system, the skin and the nervous system.

The Circulatory System.—The organs of circulation are the heart, blood vessels (arteries, capillaries and veins) and the lymphatics. The *heart* is a muscular organ, automatic in its action, but regulated by nerves from the cerebrospinal system: (1) the accelerator nerve of non-medullated fibers; (2) the inhibitory nerve (vagus) of medullated fibers. The *arteries* and *veins* are also muscular structures, also automatic in their action, but regulated by nerves from the central nervous system: (1) vasoconstrictors of non-medullated fibers; (2) vasodilators of medullated fibers. The *amount of blood* contained in the body is one-thirteenth of the body weight (Wood). The capacity of the veins is at least twice that of the arteries, their walls are much weaker and the blood-pressure in them is much lower. Blood is much more apt to be congested in the veins than in the arteries. There are three great reservoirs: (1) the portal area excited and filled by digestion; (2) the muscles excited and filled by exercise; (3) the skin excited and filled by various stimuli such as percussion, friction, reaction to heat and cold, etc. The volume of blood is constant, so when one of these areas is congested the others must be more or less anemic. The *blood-pressure* or tension (one of the chief means by which the various processes of secretion and other forms of metabolism are regulated) is maintained chiefly by the heart, but also by the contractions of arterioles, and possibly by venules and capillaries. The *pulse* indicates the rate, rhythm, force of the heart-beat and the pressure or tension in the vessels.

The Skin.—In the skin (to which most of our applications are made) are many blood vessels, glands, nerves and, connected with the hair follicles, an abundance of smooth, muscular fibers. The sweat glands are present almost everywhere in the skin, each gland receiving an artery and nerve and having a duct which discharges perspiration upon the surface. The usual rate of sweat secretion is one ounce or an ounce and a half per hour. When profuse, the rate may be two or three pounds an hour. (Kellogg.)

Perspiration may be increased by the following agents and conditions:

1. An increased temperature of the surrounding medium.
2. A diluted condition of the blood (by copious drinking of water).
3. Increased action of the heart with rise of blood-pressure.
4. Increased temperature of the blood.
5. Exercise increases the activity of the heart, and the temperature of the blood, thereby stimulating the sweat glands.
6. Percussion and friction.
7. Stimulation of the secretory nerves, and also other conditions which need not concern us here.

Perspiration is decreased by:

1. Cold, in order to prevent loss of body heat.
2. A profuse watery discharge from kidneys or bowels.

The Function of Perspiration.—Perspiration is one of the most important means by which the danger of excessive accumulation of heat within the body is prevented. Perspiration is also a means of eliminating waste products from the body. The skin and the kidneys work hand in hand.

The *sebaceous glands* secrete an oily secretion which keeps the hairs and skin soft and pliable and, when increased, makes the skin a poor conductor of heat, thus conserving body heat.

Nerves in the Skin.—The skin is one of the most important organs in which the following nerves are stationed or picketed on guard as sentinels to warn us of danger:

1. The nerves concerned in the tactile sense which inform us of pressure and locality—they may give sensations of pleasure as in massage or a skilfully adjusted bandage, or they may give the sensation of discomfort if the rubbing is too severe or the bandage too tight.
2. The nerves concerned in the temperature sense—the hot and cold spots in the skin. These may also give sensations of pleasure or discomfort.
3. The nerves which recognize pain.
4. The vasoconstrictor nerves which cause the contraction of the blood vessels.
5. The vasodilator nerves which cause the dilation of the blood vessels.

These nerves each have their own nerve endings and independent paths to special centers in the central nervous system.

The *temperature sense,* in which we are particularly interested, varies in acuteness in differing parts of the body and also varies in intensity according to the extent of surface exposed. For instance, water might feel comfortably warm to your finger, but quite hot if your whole hand were immersed and this same temperature might be unbearable if applied to your face. We are, therefore, taught to test the temperature of a flaxseed poultice by holding it to our cheek or applying it to the back of the hand which is less sensitive than the cheek, and more in accord with the chest or abdomen. For this reason, also, we must never trust our hand to test the temperature of any solution, but must use a thermometer.

"*Thermic impressions* or impressions of heat and cold are most intense when the difference between the temperature of the application and that of the skin is greatest. Rapid variations of extremes of temperature produce more marked effects than gradual changes." Hot applications ordered must be hot and the heat maintained; cold applications must be cold and the cold maintained as long as desired. Poultices which have become merely warm or ice-bags which have become warm will aggravate the conditions they are intended to relieve.

The *temperature sense* adapts itself quickly to a gradual change in temperature, but is quickly dulled by repeated or very prolonged applications. Poultices and hot fomentations, then, should be applied very gradually to the part and in giving hot irrigations or baths, it is wise to begin at a temperature a little above normal, gradually increasing to the desired temperature. We must remember, though, that the temperature sense is becoming dulled or fatigued and that a temperature comfortable to the patient may be injurious to the tissues. In this way, I have known a nurse suffering from toothache to burn her face badly with a hot-water bag; another suffering from tonsillitis burned her throat with a hot irrigation so that the tissues were a long time in healing. Also fatigued nerve endings can no longer receive or transmit messages so that applications of heat or cold, the effectiveness of which depends upon a reaction through reflex action, will give no relief if too prolonged and may even do harm. For instance, a blue, purplish skin will warn us that an ice-bag is not producing the desired reaction and should be removed until the circulation is restored in the skin.

Venous congestion also diminishes the temperature sense, hence particular caution is required in all cases characterized by venous congestion as in heart disease, and nephritis, etc. Great care must be taken in the use of heat or cold as the tissues have little resistance and are very apt to break down.

The same rules apply to the application of cold, but the skin is more sensitive to cold, impressions are sudden, not gradual as in heat, so the sudden immersion of the body in cold water is more pleasant than when the body is introduced gradually.

The nerves of the temperature sense are associated with and are the pathways to the heat-regulating and heat-producing centers at headquarters—the brain and spinal cord.

The vasomotor centers at headquarters, through the vasoconstrictors and vasodilators control the blood vessels and thus the amount of blood in the skin.

The *pain sense* is registered in the sensory centers of the cerebrum. Various forms of stimuli cause pain according to the intensity of the irritation. A temperature above 130° F. or below 32° F. does not cause a sensation of heat or cold, but of pain. Through this pain sense the shock to the sensory centers and reflexly to all the centers at headquarters may be so violent that all the vital activities—the heart, respiration, stomach, blood vessels, etc.—become disorganized and not infrequently may be the cause of death.

The Nervous System.—"The skin, as has been aptly remarked, is a harp of a thousand strings, upon which one who is a master of the necessary means may play in such a manner as to produce almost any desired physiological or therapeutic effect. The skin is the keyboard, and the nerves and nerve centers are the internal mechanism."[1]

The nerve centers chiefly affected by applications to the skin are:

1. The sensory centers located in the brain.
2. The heat-producing and heat-regulating centers located in the brain or spinal cord.
3. The vasomotor centers located in the medulla and spinal cord.
4. The secretory centers located in the spinal cord and sympathetic system.

We all know that the normal temperature of the body is 98.6° F. and that the maintenance of this temperature is necessary to carry on the chemical changes resulting in the life activities of the body—just as heat is necessary in our experiments in the chemical laboratory or just as "cooking" is necessary to produce the chemical changes in meat or other food which give to them the desired flavor. (The average temperature of the blood is 102° F., and that of the body surface, 90°-92° F.) This normal temperature, 98.6° F., is the balance between heat production—the result of glandular, muscular, or digestive activity and a high or low external temperature—and heat-elimination, which is chiefly carried on through the skin.

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[1] "Rational Hydrotherapy" by Kellogg.

The heat-regulating centers are responsible for maintaining the proper balance and every nurse recognizes the seriousness when these centers fail to "carry on" as in fever.

Here again, as in our first and second line of defense, we behold a marvelous mechanism nicely adjusted to protect the body tissues against injury—injury in this case, either from heat-production or heat-elimination in excess.

When *heat is applied* to the surface or the temperature of the blood is increased, and the body temperature tends to rise, the inhibitory heat-regulating center marshals all its forces to increase heat-elimination by:

1. Diminished production of heat through lessened cell activity. That is why we eat less and move about less in the hot weather.
2. Increased activity of the heart; and
3. Dilatation of the surface blood vessels so that blood is brought more frequently and in greater volume to the skin to be cooled.
4. Increased secretion of sweat and evaporation of sweat.
5. Increased rate of breathing—the expired air is warm and contains water vapor.

When *cold is applied* to the surface or the temperature of the blood is lowered and the body temperature tends to fall, the accelerator heat-regulating center marshals all its forces to increase heat-production and prevent heat-elimination by:

1. Increased heat-production through increased cell activity; we eat more, and eat more foods which produce heat, and we move about more.
2. Lessened activity of the heart which sends less blood to the skin.
3. Contraction of the surface blood vessels to prevent loss of heat.
4. Lessened secretions of sweat.
5. Slower rate of breathing.

These centers are so attuned one to the other and work so harmoniously together to keep the body temperature normal that,

1. If heat-elimination is increased, through the heat-regulating center, heat-production is also increased and forces are set at work to conserve it.
2. If heat-production is increased, heat-elimination is also increased.
3. If heat-elimination is diminished, heat-production is also diminished.

The Sensory Centers and the Pain Sense.—Recent experiments have demonstrated that the viscera, controlled by the sympathetic nervous system, have no definite pain sense of their own, but that they are connected through "regional areas" in the spinal cord with more or less definite areas in the skin or body wall.

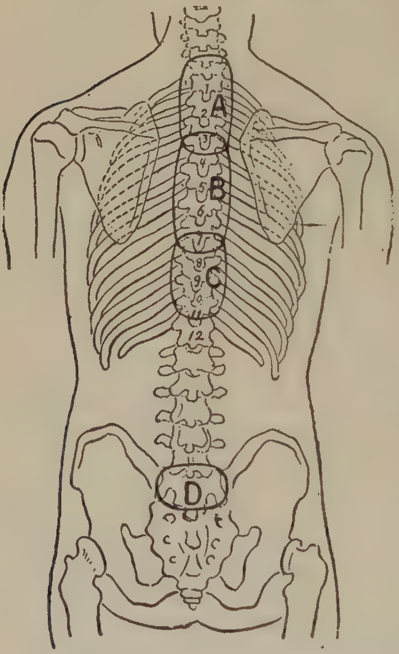

Fig. 113.—Areas in Which Pain is Sometimes Felt: A, In Cardiac Affections; B, in Affections of the Stomach; C, in Affections of the Liver, Stomach or Duodenum; D, in Affections of the Rectum or Uterus (After James MacKenzie, in "Symptoms and Their Interpretation"). (From Bastedo's "Materia Medica and Pharmacology," W. B. Saunders Co., Publishers.)

When nerve endings, then, in an inflamed viscus are irritated, the stimulus will be carried to one of these regions, to which sensory nerves also travel from a certain area in the skin or body wall. Now pain (although it is really recorded, like all conscious sensations, in the sensory centers of the cerebrum) is usually referred to that place from which the sensory nerves start so that irritation in an inflamed viscus will, by reflex action, be referred to the area in the skin or body wall with which it is indirectly connected. Thus we have the so-called "referred pains."

We have all wondered, and been rather skeptical, too, when told that a man might still suffer from pain in his fingers or toes long after his arm or leg had been amputated. The pain is a "referred pain" and is a very real and distressing thing. Something, maybe a change in the weather, has irritated the end of the nerve in the stump of his arm or leg, but the pain is "referred" and still felt in the nerve endings in the lost fingers or toes. This is not so hard to understand if we recall the tingling sensations felt in our fingers when we strike our "funny bone" and cause pressure on the ulnar nerve.

There are other examples of "referred pains" which it is well to remember. In appendicitis the patient may complain of pain in various parts of the abdominal wall remote from the usual position of the appendix, and the pain may finally localize at one point in the abdominal wall called McBurney's point. In pneumonia, pain may also be referred to the abdominal wall. The diagnosis may be so obscured that occasionally a patient suffering from pneumonia is operated upon for appendicitis. In angina pectoris, the pain radiates to the left shoulder and down the arm. In pulmonary tuberculosis, sometimes the skin over the part is too tender to touch; the same is true of inflammatory joints—the slightest jar of the bed, the touch of the bedclothes causing excruciating pain.

So we find that each viscus or internal vascular area is reflexly related to some portion of the skin or body wall, and that we may so apply counterirritants to the skin as to bring about the desired result in the particular viscus reflexly associated with it.

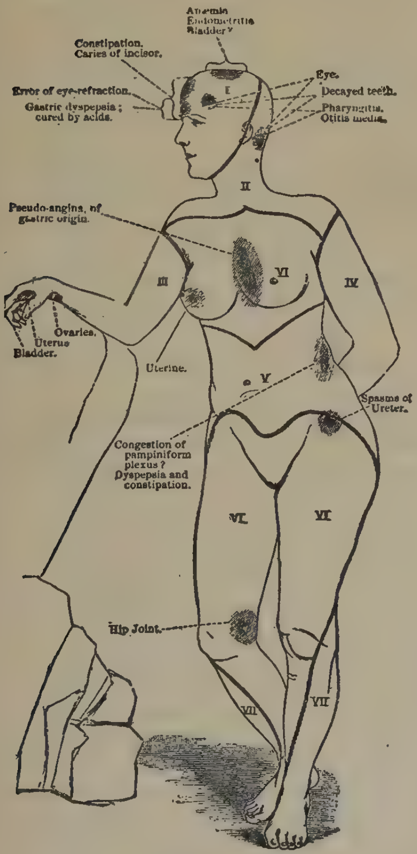
Anæmia
Endometritis
Bladder?
Constipation.
Caries of incisor.
Error of eye-refraction.
Gastric dyspepsia; cured by acids.
Eye.
Decayed teeth.
Pharyngitis.
Otitis media.
I
II
Pseudo-angina, of gastric origin.
III
VI
IV
Ovaries.
Uterus
Bladder.
Uterine.
V
Spasms of Ureter.
Congestion of pampiniform plexus? Dyspepsia and constipation.
VI
VI
Hip Joint.
VII
VII

FIG. 114.

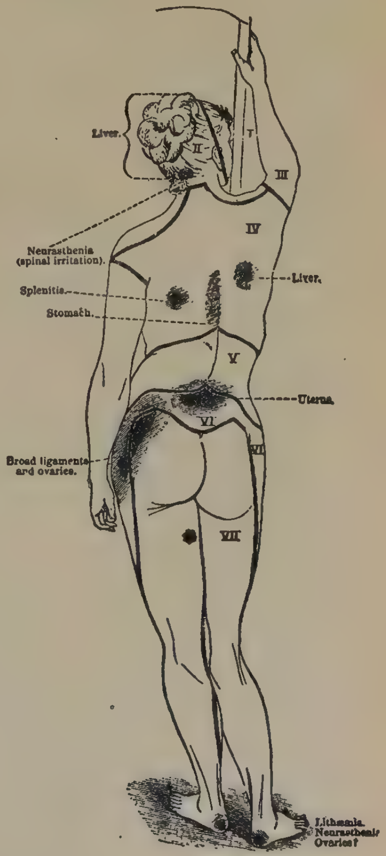
Liver.
I
II
III
IV
Neurasthenia (spinal irritation).
Liver.
Splenitis.
Stomach.
V
Uterus.
VI
VII
Broad ligaments and ovaries.
VIII
Lithæmia.
Neurasthenia?
Ovaries?

FIG. 115.

FIG. 114.—CUTANEOUS AREAS WHICH ARE THE SEAT OF REFLEX PAIN. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

FIG. 115.—CUTANEOUS AREAS WHICH ARE THE SEAT OF REFLEX PAIN. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

The following important associated areas have been taken from Kellogg:

1. The skin of the scalp, face and back of the neck is in reflex relation with the brain.
2. The skin of the back (also of the trunk and limbs) is reflexly related to the centers of the spinal cord.
3. The skin covering the neck is reflexly, through the spinal cord, related to the pharynx and the larynx.
4. The upper dorsal region, the skin of the chest in front and behind, and the inner surface of the thighs, have special vasomotor reflex relations with the lungs.
5. That portion of the chest wall overlying the heart (the precordia) is especially associated with the heart—a fact often of priceless service.
6. The skin covering the lower portion of the right chest is reflexly associated with the liver.
7. The skin surface of the lower left chest is associated with the spleen.
8. The skin covering the lumbar region is reflexly associated with the uterus, ovaries, bladder, rectum, kidneys and intestines.
9. The skin covering the lower part of the sternum is especially associated with the kidneys.
10. The dorsal spine is associated with the stomach, a fact which may often be made of great service in the suppression of nervous vomiting.
11. The skin of the epigastrium has special relations with the stomach.
12. The whole surface of the abdomen, and especially the umbilical region, is reflexly related to the intestines.
13. The lower abdomen is associated with the uterus, bladder, colon and rectum.
14. The feet, and to a considerable extent the whole lower extremities, are associated with the brain, lungs, bladder, uterus, ovaries and bowels.

Counterirritants by dilating superficial blood vessels, and allowing more blood to flow through them, also *mechanically* lessen the blood in the vessels of muscles and connective tissue supplied by the same artery. Counterirritants may also relieve by causing a stronger sensation or stimulus than that already present. That is, of two stimuli passing over the same pathway, or of two stimuli passing from different areas of the body but to the same area in the spinal cord, the stronger will always obscure or blot out the weaker stimulus. In this way, for instance, a very hot application to the skin may relieve pain in some internal organ.

Counterirritants sometimes relieve by their psychic effect. Suggestion has sometimes a very powerful influence as the numerous "faith cures" bear witness. Then, too, pain in a very sensitive area will deaden and make one forget pain in a less sensitive part. For this reason, one must be constantly on one's guard in the use of heat or other irritants. We cannot rely on the patient. He may say, with a sigh of relief, "Oh! that feels good!" and no doubt it does, but in a short time the part may be badly burned.

And now that we are more familiar with the keyboard and the internal mechanism of the body, we may sum up the means by which counterirritants produce their effects:

1. Through the circulatory system by stimulation of the vasoconstrictor or vasodilator nerves in the skin.
2. Through the circulatory system by reflex stimulation of the vasomotor centers.
3. By a thermic action through stimulation of the temperature sense.
4. By a thermic reaction through reflex stimulation of the heat-producing and heat-regulating centers.
5. By reflex action through "regional areas" in the spinal cord between areas of the body wall and the viscera reflexly associated with it.
6. By a mechanical action in tissues supplied by the same artery or anastomosing arteries or veins.
7. By a psychic effect.

The **counterirritants used** to produce varying degrees of irritation are:

1. *Rubefacients.*—These are agents used to produce the first degree of irritation which, as the name implies, means irritation sufficient to cause reddening of the skin. The agents used are:

(*a*) Physical agents which may be local or general applications of heat applied for a brief or prolonged period.

Local applications of dry heat may be in the form of a hot-water bag, baking, electric light and the cautery.

Local applications of moist heat may be in the form of poultices, compresses, stupes, a hot foot-bath, an arm bath, a sitz bath, and irrigations.

General applications of dry heat may be in the form of a hot-air bath or an electric bath.

General applications of moist heat may be in the form of vapor baths, hot packs or hot tub-baths.

(*b*) Mechanical agents such as friction, percussion, pressure, or suction.

(*c*) Chemical agents such as mustard, turpentine, or iodin, etc.

2. *Vesicants* are the agents used to produce the second degree of irritation, which as the name implies means the formation of a vesicle or blister. An example of a vesicant is the cantharides plaster.

3. *Escharotics* are the agents used to produce the third degree of irritation which, as the name implies, means the formation of an eschar, which is a slough or the actual death of tissue. Examples would be strong acids or alkalies, copper sulphate, silver nitrate, or the cautery.

When the following treatments give relief in both medical and surgical diseases, as inflammation is the characteristic lesion in both, their uses in each will be considered in the present chapter.

PHYSICAL RUBEFACIENTS

The Thermo-Cautery

The application of the Paquelin thermo-cautery, as a rubefacient, consists in an application of dry heat made by passing the red-hot platinum tip of the cautery to and fro over the affected part until it becomes well reddened. Sometimes the skin is lightly flicked with the red-hot tip. The Paquelin cautery consists in a hollow, platinum tip which is screwed on to a hollow metal rod or cylinder, and handle which in turn is connected by rubber tubing to one arm of a metal container. To another arm of this container a rubber tubing and a soft rubber bulb covered with netting are attached. In the metal container there is a small sponge which is saturated with benzine before using the cautery. By squeezing the rubber bulb the fumes of benzine may be forced along into the platinum tip. When the tip is heated in a flame it may be kept constantly at the required temperature by simply squeezing the rubber bulb gently so as to keep the tip supplied with benzine fumes. The metal container is provided with a valve by means of which the escape of the fumes may be prevented when the apparatus is not in use.

The electric cautery is now commonly used and is the most convenient form of apparatus.

The **cautery is used** for the relief of inflammation and pain in sciatica and other painful nerve trunks, in lumbago, torticollis and other forms of muscular rheumatism.

It is also particularly valuable in the treatment of chronic inflammation of joints, bones, nerves, and the spinal cord. Directly applied it is the most powerful counterirritant.

The Method of Procedure.—The treatment is usually given by a doctor. The nurse's duties are to prepare the patient and the apparatus and to keep the platinum tip supplied with benzine fumes and at the right temperature.

To prepare the patient place him in the most suitable and comfortable position. Arrange the bedclothes neatly so as to avoid unnecessary exposure. An extra blanket may be necessary to protect and keep the patient warm. Reassure the patient that there is no danger of burning or pain, but instruct him to keep still. Usually it is best not to allow the patient to see the red-hot tip except when, as sometimes happens, the treatment is given for its possible psychic effect.

Before taking the apparatus to the bedside it should be examined to see that it is intact and in good working order. When the treatment is being given the platinum tip should be kept red-hot, not white-hot. Avoid forcing too much air into the air bulb or reservoir, so as to prevent its bursting. As a rule the heated platinum tip is not allowed to touch the patient. As a precautionary measure, in case of restlessness, some doctors prefer to have a layer of gauze over the part. Sometimes, however, the skin is touched lightly along the path of the nerve, etc., with the heated tip. Avoid touching anything with the heated tip, not only because it will burn whatever it touches, but because, when heated, it is soft and easily dented. Never cool the tip by putting it in water. When the treatment is completed, rearrange the bedclothes and make the patient comfortable. Before putting the apparatus away see that the valve is closed so as to prevent the evaporation and loss of any benzine which may remain.

Other physical rubefacients in the form of local applications of dry and moist heat have been discussed in Chapter XVI. These should be reviewed for a general discussion and understanding of counterirritants. General applications of heat are discussed in Chapter XXIII.

CHEMICAL RUBEFACIENTS

The chemical agents used as rubefacients or reddeners are mustard, camphor, iodin, ammonia, chloroform, turpentine, ichthyol, methyl salicylate and antiphlogistin.

The effects produced by these chemical agents are the same as those produced by heat and other counterirritants.

The use of mustard has already been discussed in Chapter XVI.

CAMPHOR

Camphor is obtained by boiling the twigs and wood of the camphor tree which grows chiefly in China and Japan. It is a highly volatile, inflammable, gummy substance, soluble in alcohol, ether, chloroform, and the fixed and volatile oils.

The Uses of Camphor.—Camphor is used as a counterirritant in the form of a liniment or camphorated oil.

1. To relieve pain in inflammation of the chest or throat.
2. To relieve pain in inflamed joints from sprains or rheumatism.
3. To relieve pain in inflamed muscles or in neuralgia.

Camphor is also used as an ingredient of various other liniments, such as soap liniment, chloroform liniment, menthol-camphor and chloral-camphor, etc.

The Method of Applying Camphor.—Camphor liniment is an oily substance and should be well rubbed into the skin, using the open palm of the hand. The beneficial effects are derived equally, if not to a greater extent, from the mechanical stimulus of the rubbing than from the camphor, therefore the rubbing must be thorough. Oily substances rub in better and give greater comfort to the patient if previously warmed by standing the container in hot water. As camphor is highly volatile, to prevent evaporation and chilling and to prolong the effects, the part must be covered with flannel, which is a poor conductor of heat. The covering is necessary also to prevent staining the bed linen, etc., with the oil, as the stain from camphorated oil cannot be removed.

Remember that the application is intended only to redden the skin. Camphor will blister and was formerly used as a vesicant or blisterer, the application being covered with a watch-glass crystal to exclude the air.

IODIN

Iodin is used as a counterirritant in the form of an ointment or as the tincture of iodin.

It is a mild, slow counterirritant and, if properly applied, may be used continuously to the skin without causing pain or injury to the tissues if the skin is intact. If a large amount is used or if too concentrated or improperly applied, it produces blisters.

Iodin acts as a powerful irritant to mucous membranes.

Conditions in which Iodin is Commonly Used:

1. In chronic rheumatism of joints or muscles to hasten the absorption of waste products.
2. In synovitis to check the accumulation of fluid, to stimulate absorption, and to relieve pain.
3. In pleurisy and pneumonia for the same purpose.
4. In chronic bronchitis, iodin is sometimes applied to the supraclavicular spaces to lessen secretions and relieve an irritating cough.
5. In chilblains, iodin applied in the form of an ointment (the tincture of iodin diluted one-half with lard) gives great relief.
6. For corns and bunions, to relieve pain and cause the disintegration, absorption and removal of the excess connective tissue.
7. In ulcers of the leg—painted over and around the ulcer.
8. For inflamed gums or throat and for fever sores.
9. For ring-worm and other parasitic skin diseases.
10. For enlarged glands.

Method of Applying Iodin.—It is well to remember that some people have an idiosyncrasy for iodin and its indiscriminate use may cause gangrene or death of the tissues. I know of one case in which gangrene followed the application of iodin for bunions and another in which gangrene of the abdominal tissues followed the use of iodin as a disinfectant in preparation for an operation.

Tincture of iodin is an alcoholic preparation. Alcohol evaporates readily, leaving a stronger preparation of iodin. For this reason long-standing preparations should not be used as they are likely to cause a severe iodin burn. A burn produced by iodin causes agonizing pain which even morphin will not relieve. (The application of an ice-bag sometimes gives great relief.) The burned tissues are also very slow in healing. Iodin must not be applied to a moist surface nor must wet towels, dressings or ointments, etc., touch a surface painted with iodin. This accident sometimes occurs in the operating room and the result is a severe iodin burn and blisters. If more than one application is to be made, the part must be dry before the second coat is applied. Usually enough iodin is used to produce a mahogany hue, but not too dark a color. Apply the iodin evenly to avoid blistering. Apply with cotton or a camel's-hair brush. Do not let the strokes overlap. In applying other coats make the strokes take a different direction each time. If too much iodin has been applied and the patient complains of pain, it should be washed off with alcohol. Iodin is soluble in alcohol, whisky, gin, cologne water, ether or chloroform. Applications to the skin should be covered to prevent evaporation and to prevent staining of the bed linen, etc.

AMMONIA

Ammonia is occasionally used as a counterirritant in the form of aqua ammoniæ, aqua ammoniæ fortior or stronger water, and ammonia liniment which consists of ammonia water mixed with cotton-seed oil.

Ammonia is a very powerful irritant and not only causes redness of the skin, but very quickly a blister and may produce sloughing of the part.

When used as a *rubefacient,* saturate a small piece of cotton or gauze and apply it to the part. Cover with oiled muslin to prevent evaporation and bandage loosely. Watch the part carefully and do not leave the application on longer than five minutes.

When used as a *vesicant,* a few drops may be applied to the skin and the part covered with a watch-glass crystal. A blister will form in about ten minutes.

CHLOROFORM

Chloroform is a non-inflammable, volatile liquid. On long standing or if exposed to heat, it may decompose, forming free hydrochloric acid or free chlorin, both of which are very destructive to the tissues.

Chloroform is used as a counterirritant in the form of a liniment consisting of soap liniment (tincture of green soap) 70 per cent. and chloroform 30 per cent. It also contains alcohol which acts as a preservative and prevents decomposition.

Purposes for which Chloroform is Commonly Used:

1. As a rubefacient for muscular, joint, or neuralgic pains, as in lumbago and gout.
2. To relieve toothache. When applied on cotton in a decayed tooth chloroform sometimes gives relief.

Method of Applying Chloroform.—Chloroform liniment may be painted over the area or it may be rubbed in gently. If the skin is sensitive and the application burns, stop rubbing for a moment to allow evaporation.

In applying, cover only the area to be treated. Use a small amount only and never allow it to run into any cracks or crevices, such as around the breast or in the groin, etc. If allowed to do so it will surely cause blisters which will be very painful and will heal very slowly.

The application may be covered with flannel to prevent evaporation or it may be left uncovered, the treatment being finished when the rubbing is over. When the part is covered watch it very carefully and do not allow it to blister.

TURPENTINE

Turpentine contains a volatile oil, the oil of turpentine or spirit of turpentine, which is obtained by distilling turpentine. As a therapeutic the purified or doubly distilled oil is used.

The oil or spirit of turpentine is highly volatile, exceedingly inflammable and if placed near a light or added to any strong mineral acid will take fire.

It is very irritating to the skin and mucous membrane.

Conditions in which Turpentine is Used:

1. In bronchitis. A preparation of turpentine thoroughly mixed with sweet-oil in the proportion, usually, of one part of turpentine to two parts of oil is used.
2. For sprains and enlarged joints turpentine liniment is used.
3. Turpentine may be added to the hot stupe, applied over an area for deep-seated inflammation. The application is made in the form of a hot stupe to which the turpentine is added to increase the stimulating effect of the heat. Extreme care must be taken to avoid blistering.

ICHTHYOL

Ichthyol is a dark brown, oily-looking sulphur compound soluble in water and oils, but not in alcohol. Its therapeutic value depends largely upon the sulphur ingredient. Ichthyol is obtained from the shale, a fish from which its name is derived.

It is used as a counterirritant either in the form of an ointment (10 to 50 per cent.) or as a 50 per cent. solution.

Conditions and Purposes for which Ichthyol is Used:

1. In acute articular rheumatism to relieve pain, tenderness and stiffness. Ichthyol ointment may be smeared over the inflamed part or spread on lint, which is then wrapped about the joint. After the acute stage has passed the ointment may be rubbed in.
2. In acute sprains and swollen glands to lessen pain and swelling.
3. In erysipelas and chronic skin diseases such as acne and eczema.
4. In burns, sunburns, frostbites, and chilblains, corns and bunions, to relieve pain and swelling.
5. In boils or carbuncles, bedsores and other sloughing or

infected areas to promote the absorption of waste products and stimulate healing. It is thought to favor local resistance by promoting a local leucocytosis.

6. In pelvic inflammation with an inflammatory exudate and vaginal discharge. A tampon or gauze saturated with the solution is inserted in the vagina.

The Method of Application.—Ichthyol is seldom applied by rubbing. It is usually painted or smeared over the part with a cotton swab or camel's-hair brush. It may be applied to lint or gauze which is placed over the part. In any case it should be covered by a dressing lightly but securely fastened in place in order to prevent staining of the bed linen, etc. Ichthyol is usually applied in the form of an ointment. Ichthyol alone is soluble in water and so is easily removed from linen but when mixed with vaseline, the oil fixes the stain, prevents its removal, and so leaves a very unsightly stain. A preparation of ichthyol and collodion is sometimes used for corns and bunions, etc. It does not stain.

Methyl Salicylate

Methyl salicylate may be artificially prepared from carbolic acid, or it may be obtained from the oil of gaultheria or wintergreen which is contained in the volatile oils of the birch and wintergreen. The oil is 96 per cent. methyl salicylate.

Methyl salicylate is used as a counterirritant chiefly in acute and chronic articular rheumatism.

Method of Application.—The oil may be painted over the part, or it may be placed on lint or on a compress which is wrapped around the joint. The application is then covered with oiled muslin to prevent evaporation. The lint should be supported and all unnecessary movements of the joints avoided. Painful joints may be protected from friction and jarring movements by well-padded splints and from contact and pressure of bedclothes by the use of cradles.

When the pain is not too acute, the oil may be rubbed on the part, in this way combining the stimulating effect of the rubbing with the irritating and stimulating effect of the oil. This increases its counterirritant effect and adds to the comfort of the patient. Of course, when this method is used, as the oil is volatile, some of its effects are lost. The diminished stiffness, the increased warmth and comfort which result, however, testify to the increased benefit due to the rubbing.

After the application is made the part is covered with a compress or lint and oiled muslin (to prevent evaporation and loss of heat) and bandaged. Frequently the part is covered with strips of cotton wadding and flannel or bandaged with flannel bandages in order to increase the warmth and comfort.

Antiphlogistin

Antiphlogistin is a clay-like poultice (cataplasma kaolini) consisting of boric acid, oil of peppermint, methyl salicylate, thymol, glycerin and kaolin, a clay-like substance, consisting of aluminum silicate. This preparation is also called fullers' earth.

Effects of the Application.—While antiphlogistin contains chemical irritants it is claimed that the effects it produces are due largely to the moist heat. It is said to have less power as a counterirritant and to retain the heat for a shorter time than a flaxseed poultice. It is also said to have little power of absorbing water, but the glycerin in it helps to abstract moisture from the tissues (and from the air) and keeps it moist.

Conditions in which Antiphlogistin is Commonly Used:

1. In inflammatory diseases of the chest, such as pleurisy and bronchitis. The effects produced are similar to those produced by a flaxseed poultice or mustard paste.
2. In toothache, when applied to the face, the poultice frequently gives great relief.
3. In inflammation of glands and joints to relieve pain and swelling.

Method of Application.—The required amount of antiphlogistin is placed in a small receptacle, which is then allowed to stand in a basin surrounded by boiling water until the desired temperature is reached. The water is kept boiling until the antiphlogistin is thoroughly heated. It is then spread on muslin or old linen and applied directly to the part. A binder or bandage is used to hold the poultice in place. As the virtue lies chiefly in the heat, the poultice may be covered by flannel and a hot-water bag may be used to increase and retain the heat.

When a large area is to be covered and the poultice is therefore large and unwieldy, it is best to spread it at the bedside of the patient so that it may be applied as hot as possible.

Applications are sometimes ordered every four hours over a period of several hours. When only one application is to be made, it is left on until the clay is dry and crumbles.

On removal, wash the skin with hot water and soap, and dry gently. The flannel and hot-water bottle may be continued if desired.

MECHANICAL RUBEFACENTS

Dry Cupping

Dry cupping is a means of producing a counterirritant effect, through suction, by the application to the skin of specially made cups (Biers'), or small glasses in which a vacuum is created by heating the air contained in them. When the air is heated it expands and part of it escapes—at this point the glass is placed on the skin. As the air cools it condenses so that a partial vacuum forms in the glass into which the tissues beneath are drawn. These tissues are thus expanded, their blood vessels are dilated so that an increased amount of blood flows through them. In this way the circulation is stimulated and congestion relieved in the deeper tissues. The Biers' cups are glasses of various shapes, provided either with a rubber bulb by which air may be exhausted, or fitted with a valve or stopcock to which a small exhaust pump may be attached to exhaust the air in the glass.

Conditions and Purposes for which Cupping is Used:

Cupping may be applied to the following areas:

1. To the chest, either posterior, anterior or both, in asthma, edema of the lungs, or pneumonia with cyanosis in order to relieve pain, dyspnea and congestion or stasis of blood.
2. To the lumbar region to relieve congestion or stasis in the kidney and to relieve suppression.
3. To inflamed areas such as boils, etc., in order to stimulate the circulation in the part and cause an active hyperemia. This increases the local resistance by bringing a free supply of healing blood, laden with nourishment, leucocytes and antibodies, and by the withdrawal of waste products.

Cupping is *contraindicated* in acute pleurisy or peritonitis on account of the danger of injuring the parietal serous membranes.

Method of Procedure.—*Preparation of the Patient.*—It is particularly important that this treatment should be performed as quietly, reassuringly, and as skilfully as possible. The thought of being burned is always an alarming one, so that, if the patient is conscious or not so depressed or toxic as to be indifferent to what is being done, he should be reassured on this point and also assured of the relief and comfort which usually result.

Only the necessary area should be exposed and every precaution taken to prevent chilling, especially of the arms and shoulders when cupping the chest. The feet and body should always be warm.

As the patient is frequently in a very serious condition, he should be disturbed as little as possible, and all exertion on his part avoided. For instance, in cyanotic pneumonia, in which the crippled heart, poisoned by toxins and overworked, is conscientiously trying to keep up its work under tremendous difficulties, great care must be taken in moving the patient. In cupping the posterior chest, it is wise to find out from the doctor to what extent the patient may be moved. Sometimes it is less difficult for the patient to breathe sitting up. In this case the anterior chest, arms and shoulders should be protected with a blanket and the patient should lean forward, supported by a bed-tray, which is protected by a pillow. His back must be supported with a pillow and only the necessary exposure allowed. When he is not allowed to sit up and can breathe only when lying on his side, he is very carefully turned from side to side for the application. In either case watch his color, pulse and respiration closely.

Preparation of the Area.—It is important to know the exact area to be cupped. If in doubt, the doctor should be asked to outline it on the patient. To obtain suction and regulate the circulation in the affected viscera, the cups must be applied to soft tissues capable of being drawn up. They must not be applied over bony surfaces, such as the sternum, clavicle, scapula or spine. In cupping either the anterior or posterior chest, the application should extend well around on the sides. (See Figures 37 and 38.) In cupping the anterior chest of a man, the cups may extend to the nipple. In women this is usually impossible. The area must be shaved if hairy (1) to prevent fire; (2) to secure a better suction; (3) to avoid pain.

The necessary *articles* are usually brought to the bedside on a tray. They consist of six or eight cupping glasses, an alcohol lamp, matches, absorbent cotton, a glass rod, alcohol, a glass to contain the alcohol, a piece of old blanket to extinguish the flame, and two towels. One or two blankets will be required. The cupping glasses should have thick, smooth rims and should be clean and dry. They are placed conveniently on a folded towel (to avoid noise) on the side of the table near the patient. The articles on the tray are arranged conveniently and so that the lighted swab will not pass over the open glass containing the alcohol. This glass should be distinct in shape from the cupping glasses. The table also should be arranged conveniently. Some nurses find it more convenient to have it placed at the head of the bed while others prefer to have it moved toward the center of the bed.

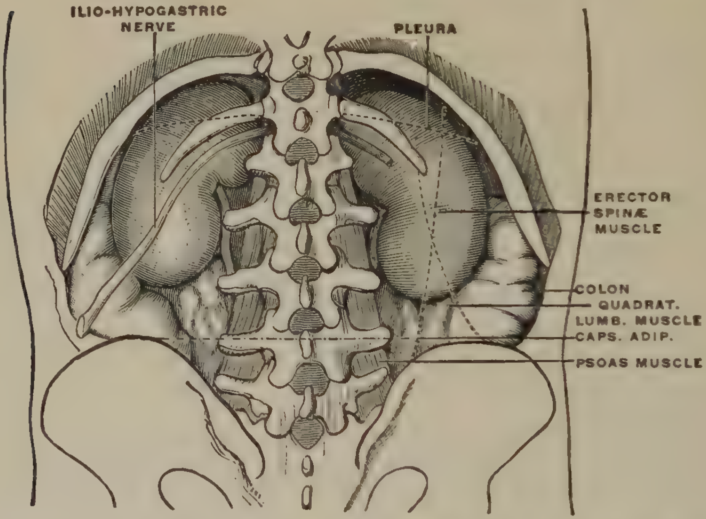

Fig. 116.—Position of the Kidneys Seen from Behind. (From Woolsey's "Applied Surgical Anatomy," Lea and Febiger, Publishers.)

The greatest care must be taken to avoid burning the patient or setting fire to the bedding, etc. While such a calamity might never occur, the results are so serious and at least so alarming, that it is necessary to take the following precautions:

1. Have blankets so disposed around the immediate area that no cotton or linen is exposed to the danger of fire. The blankets also serve to prevent chilling, which is very essential. For instance, in cupping the anterior chest, one folded blanket may be placed under the patient, the upper fold being used to cover the patient's hair, shoulders and arms, while the lower fold protects the pillows and bed. It may also serve to extinguish a possible fire. A second blanket may be used to cover the turned-down upper bedding or the spread and upper sheet are sometimes turned down, leaving only the bed-blanket exposed.
2. In placing the articles on the tray, the alcohol should be in the farthest corner from the patient, and away from the lamp.
3. The cotton which is wound around the applicator or glass rod must be thoroughly moistened with alcohol so that the flame is due to burning alcohol, and not to cotton, shreds of which would be apt to fall and burn the patient.
4. Avoid using too much alcohol so that it drops or runs along the rod, spreading the flame.
5. Never use the cotton if charred.
6. Don't have too large a flame as this will heat the rims of the glasses. Don't heat the rims, heat the air inside. There is no danger of burning if the flame is inside the glass, not around the rim.
7. The glasses should be clean. Some say the glass should always be dry when applied; others wet the rim with water to prevent it from becoming hot and burning. Both methods may be used.

In applying the cups never leave small areas untreated and thus exposed to chilling. The vessels of the whole area should be evenly dilated. The cups, however, must not be applied where a former cup has made a deep mark.

The *duration* of the treatment is ordered and is usually from ten to twenty minutes, during which repeated applications are made until the desired result is obtained. In removing a glass, always insert your finger to allow the escape of air so that it may be removed without discomfort to the patient. Reddening of the part indicates the desired result has been obtained. Never allow the part to become a dusky red. This shows that the congestion caused is so great that small capillaries have ruptured—a condition similar to that seen in a bruise. All marks should disappear in from one-half to one hour.

When the whole area has been covered and the desired result obtained—uniform reddening of the skin and relief of congestion in the viscus—the part is dried gently, a little talcum or sometimes vaseline is smeared over the part, and a flannel or pad may be left on.

During the treatment, it will be noticed that the surface of the skin becomes quite moist, likewise the glass. This is moisture resulting from the cooling and condensation of heated air and not moisture extracted from the tissues, as is sometimes supposed.

VESICANTS, EPISPASTICS OR BLISTERERS

The vesicant or blisterer is the second degree of counterirritation and, as you have learned, may be produced by any rubefacient if the strength or duration of the application is increased. When this degree of irritation is required, however, the cantharides plaster or the Spanish fly blister is almost universally used.

Cantharides is the dried and powdered brilliant green beetle, Cantharis vesicatoria, or Spanish fly. While called the Spanish fly blister, the insects come from Italy, Sicily and Southern Russia as well as from Spain, and it is said that those from Russia are the best.

The plaster is made by spreading the cantharides ointment on adhesive plaster.

The Action of Cantharides.—Cantharides is very irritating but acts slowly in producing a blister. If the application is large, enough cantharides may be absorbed to cause fever, nervousness, acute nephritis with bloody urine or suppression and inflammation and tenesmus of the bladder. For this reason it is necessary to watch the amount and character of the urine voided for at least twenty-four hours after the application is made.

The fluid which forms beneath the skin is not from the exudate in the part treated, as might be supposed, but is serum drawn from the adjoining tissue or lymph spaces. It is exactly the same as fluid in a blister on the heel caused by irritation of a shoe, except that it will contain the irritating cantharides. The blister is only an incident which indicates the extent of the irritation. It is not a benefit, but an evil which some think contraindicates the use of cantharides.

Purpose of the Applications:

1. To produce a more powerful and prolonged counterirritation for deep-seated inflammation.
2. To cause the absorption of a collection of fluid or exudate from an inflammatory area.

Examples of conditions in which cantharides is used are pleurisy with effusion, pneumonia, iritis, synovitis, inflamed glands, acute rheumatic joints or chronically enlarged joints.

Cantharides is contraindicated:

1. In inflammation or congestion of the kidneys.
2. In acute superficial inflammation when the skin is inflamed. The *flying blister* is sometimes used in these cases, that is, very small applications are made around the area at some distance.

Some doctors believe that such intense irritation is not only undesirable, but harmful. Blisters are painful and prevent further applications and leave a skin lesion to be treated.

Method of Applying a Cantharides Plaster.—Figures 117 and 118 show the areas where the applications are usually made. Blisterers should never be applied over bony prominences where healing is slow, nor directly over an inflamed area. They should be applied over a part well supplied with blood and lymph vessels.

The *preparation of the skin* is the same as for an incision. It is shaved, cleansed and disinfected. The size of the plaster applied is as ordered but seldom exceeds one to two inches square. Otherwise the irritation and the blister would be greater than necessary and too much cantharides would be absorbed. It is not necessary to oil the plaster (unless it is an old one), as it is adhesive and the heat of the skin causes it to adhere. When applied it is covered with a watch-glass crystal fastened with adhesive or it may be covered with a light bandage, loose enough to allow the blister to develop without unnecessary pain. An elevated dressing in the form of a cap may be made with oiled muslin and adhesive.

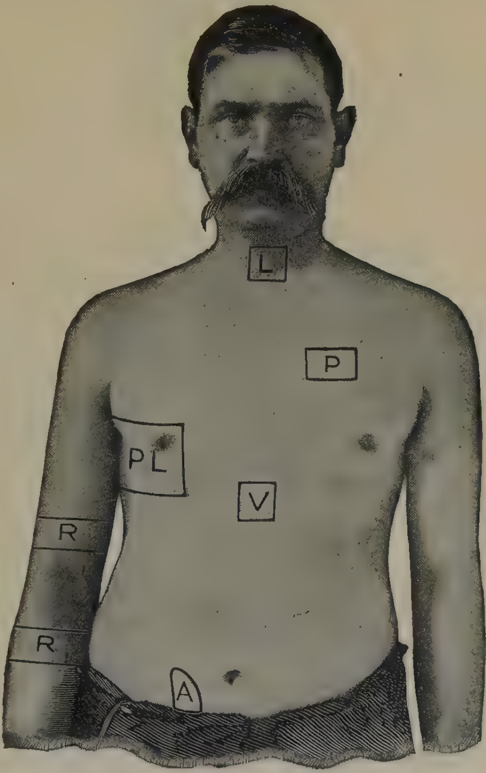

Fig. 117.—Showing the Areas in Which Blisters Are to be Placed: P, Pericarditis; A, Appendicitis; L, Laryngitis; V, Vomiting or Gastritis; PL, Pleuritis; R, Inflammation in Joint. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

The *duration* of the application and the time required for the formation of the blister vary. Sometimes the plaster is removed at the end of twenty minutes, when the skin is well reddened, and a flaxseed poultice applied to complete the formation of the blister; or the plaster may be left on from four to eight hours, during which time a blister usually forms. If not, the plaster is removed and a hot poultice applied, which, being moist, softens and expands the skin and causes the blister to develop. The poultice is not applied until after the plaster is removed as the heat promotes absorption, softens the tissues and, together with the cantharides, may cause sloughing.

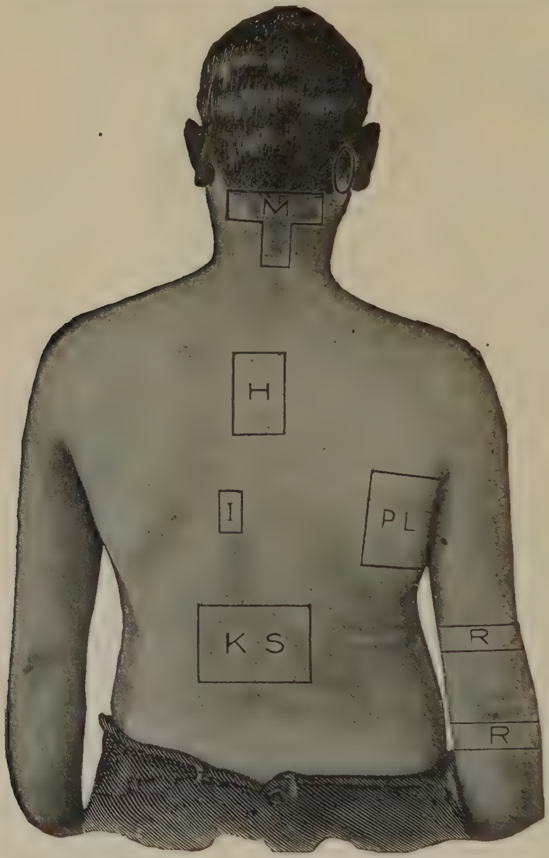

Fig. 118.—Showing the Areas in Which Blisters Are to Be Placed: O, Earache or Vertigo; M, Meningeal Inflammation; H, Hemoptysis; PL, Pleuritis; I, Intercostal Neuralgia; KS, Renal or Spinal Irritation; R, Rheumatism or Inflammation in Joint. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

Removal of a Cantharides Plaster. — The plaster is removed very gently so as not to break the blister. Oiling the edges softens and aids its removal. Gently oil the surface to complete the removal of the cantharides.

The treatment of the blister varies. It is a necessary evil which, particularly if small, some think will take care of itself by reabsorption. In that case it should be covered with a sterile and soothing dressing to prevent infection, infection being much more apt to occur where fluid is present. If the blister is large, it is usually thought wise to open and drain, for two reasons. One is that there may be considerable cantharides in the fluid so that absorption is undesirable, the other is that absorption may be very slow, the part may take a long time in healing and run the danger of being infected.

The *opening* of the blister is a sterile procedure. A small incision is made with sterile scissors in the lower corner of the blister, and all the fluid is removed and received in a sterile wipe. The fluid must not flow over the surrounding skin as it contains cantharides and irritates. Apply a sterile dressing and bandage.

Watch the urine for at least 24 hours for symptoms of nephritis.

Cantharidal ointment or cerate is sometimes used. It is spread on muslin and applied directly to the surface.

Cantharidal collodion is also used. It is more cleanly but there is more danger of absorption from this application. To use this preparation first outline the required area with oil or vaseline and paint the solution on with a camel's-hair brush or cotton. Allow this to dry, then apply the usual dressing.

ESCHAROTICS OR CAUSTICS

Escharotics are substances which produce the third degree of counterirritation, that is, destruction or death and sloughing of the tissues.

When an inflammatory process becomes sluggish or chronic, that is, when liquefaction and resolution are delayed and milder counterirritants fail to stimulate and shorten the process, sometimes harsher methods are resorted to in order to remove the unhealthy tissue and give the cells a chance to heal.

Action of Escharotics.—These agents cause so much tissue change that counterirritation is very prolonged. They are very irritating and penetrating and for this reason are not used extensively.

Escharotics are Applied for the following Purposes:

1. To stimulate healing in small superficial areas, such as sluggish ulcers.
2. To destroy the poison, neutralize the effect and prevent the absorption of poison from dog-bites or poisonous snake bites.
3. To remove warts, polypi, hypertrophied tissue and an over-production of granulations.

Escharotics Commonly Used:

1. Acids—sulphuric, nitric, salicylic, glacial acetic, carbolic
2. Alkalies—potassium, sodium, and calcium hydroxid.
3. Metallic salts—silver nitrate (lunar caustic), copper sulphate (bluestone), zinc chlorid, burnt alum and arsenious acid.
4. Carbon dioxid, liquid or solid.
5. Phenol or carbolic acid.
6. The cautery in actual contact with the tissue.

Method of Application.—Escharotics are applied in the form of a solution, ointment, or solid preparation. Care must always be taken that the application is made to the local area only and that the surrounding tissue is protected. In some cases, when the desired result has been obtained, the action of the caustic is checked by neutralizing it as in the use of alcohol following an application of carbolic acid.

CHAPTER XXII

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY LOCAL OR GENERAL DEPLETION

DEPLETION, BLOOD-LETTING OR DECREASING THE VOLUME OF BLOOD

Leeching

Leeching is a method of abstracting blood for the purpose of relieving local inflammation or acute congestion. It is often used in preference to the knife, which would leave a scar and might cause excessive bleeding.

"The leech (hirudo) is an annelid worm with a sucker at each end of its body. At its mouth end there are three teeth arranged in a triradiate manner so that its bite consists of three short deep gashes radiating from a common center" (Bastedo).

Although leeches in plenty may be found in the ponds and marshlands of America, in medicine the imported leech, chiefly from Sweden, is used. The Swedish leech is considered the best because it extracts about half an ounce of blood, while the American leech only extracts from one to two drams.

The Action of the Leech.—The mouth of the leech, after its bloodsuckers are attached, secretes a substance (hirudin) which prevents the coagulation of blood so that it flows freely. After the leech is removed, some of this substance may remain in the tissues so that the hemorrhage may persist for some time. The effect produced is one of counterirritation as well as depletion.

Conditions and Areas to which Leeches are most commonly Applied:

1. To the temple or nape of the neck in meningitis.
2. To the temple, the forehead, in front or behind the ear for inflammation of the eye or ear.
3. Behind the ear to relieve cerebral congestion.
4. In the treatment of swollen joints after sprains, etc.

The following table indicates the areas of the skin to which leeches or cups are to be applied to directly affect the viscera by abstraction of blood:

Areas to be depleted	*Areas to which depletion is to be applied*	*Paths of communication through which depletion takes place*
Appendix	Groin	Spermatic veins, circumflex, iliac and ileolumbar veins
Liver	Anus	Portal vein, anal and perineal vessels, hemorrhoidal veins
Uterus	Anus	Uterine and hemorrhoidal veins
Bladder and prostate	Anus	Prostatic and hemorrhoidal veins
Testicle	Groin	Spermatic and inguinal veins
Pericardium	Third, fourth and fifth left intercostal spaces	Pericardial and internal mammary veins
Lung	Third right intercostal space between the vertebral column and shoulder blade	Bronchial and azygos veins and superior intercostal veins
Eye	Mastoid apophysis	Ophthalmic vein
Tonsil	Angle of the jaw	Cavernous sinus, petrous and lateral sinus

Disadvantages in the Use of Leeches:

1. They may not be clean and in any case are not aseptic.
2. They may wander and get in one of the body cavities, such as the ear, nose, vagina, etc.
3. They remove an uncertain quantity of blood.
4. They may have a bad psychic effect on a nervous patient.

When not in use the leech is kept in a jar of clean, fresh water, with a little sand in the bottom, and the jar must be tightly closed with a perforated cover.

Method of Application.—The *skin* must be clean, shaved if necessary, and free from odors, or the leech will not take hold. Prepare the skin as for an incision but do not use disinfectants leaving an odor. Dry with a sterile wipe. Be sure the leech attaches itself to the desired spot only. To insure this place it in a glass tube so that the head comes first—the head is recognized by its three-cornered mouth. Hold the tube over the spot and do not remove it until the leech has taken hold so as to prevent it from migrating. It must not be placed over a vein but over a spot where pressure may be made if necessary to control bleeding. Leech-bites make small permanent scars, so they are not usually applied on the face or other conspicuous parts.

If the leech will not take hold, it may be coaxed or stimulated by placing a little sweetened milk or water on the spot or by pricking the spot with a sterile needle and drawing a drop of blood. Gently stroking the back of the leech sometimes helps. Putting the leech in very cold water for a minute or two is one of the very best ways of arousing its appetite. The patient should never be left alone because of the wandering habits of the leech. For safety, the cavities of the nose and ears, etc., may be plugged with cotton, especially the ear when the application is near the ear. To prevent the uncomfortable sensation of contact with the body of the leech, a layer of gauze is placed between it and the skin after it has taken hold.

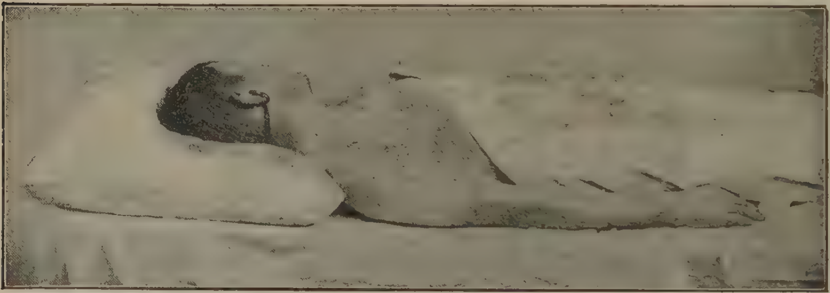

FIG. 119.—SHOWING THE APPLICATION OF LEECHES IN FRONT OF AND BEHIND THE EAR. The auditory meatus is plugged with cotton to prevent the leech from entering the canal by accident. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

Removal of the Leech.—The leech must never be forcibly removed or its teeth or suckers will remain and cause continued bleeding and inflammation in the part. (In any case the bleeding may persist so it is wise to protect the bed before making the application.) When it has drawn enough blood, the leech may easily be removed by sprinkling it with a little salt or by squeezing its head. When satisfied, it will drop off of its own accord. On removal it should be destroyed immediately. Cover it with salt and then burn. Never use it a second time. Never throw it down the drain pipe or in the garbage tin alive. After removal, if there is no hemorrhage, apply a sterile dressing. If bleeding continues, and is prolonged, it may exhaust the patient so it is necessary to control it. It may be controlled by applying a sterile dressing and a tight bandage with pressure or by astringents or styptics such as adrenalin, alum or tannic acid or by applying ice compresses with a tight bandage.

WET CUPPING

Wet cupping is also a method of abstracting blood for the purpose of relieving local inflammation or acute congestion. The blood is drawn by suction through one or more openings in the skin made with a sterile scalpel.

Wet cupping is seldom used to-day, but is occasionally used in the following conditions:

1. Applied to the chest wall to relieve edema of the lungs or congestion in pneumonia.
2. Applied to the kidney region in acute nephritis to overcome or relieve congestion and suppression of urine.
3. Applied over the temple or behind the ear in inflammatory conditions of the eye or ear.
4. Applied over badly infected wounds to extract fluid or pus. Biers' cups are generally used for this purpose.

Method of Application.—The treatment is a sterile procedure—the skin is prepared as for an incision, shaved if necessary, washed with soap and water and a disinfectant. Avoid the use of alcohol, or ether, both of which are inflammable and if left on the skin might ignite and cause a severe burn. The scalpel, glasses, solutions, ointments and dressings, etc., are also sterile. The bed is protected and the part draped with sterile towels.

The application is made as in dry cupping, except that the cups are left on until sufficient blood is extracted, one application only being necessary. When completed, cleanse the part with a sterile solution and apply a sterile dressing.

Measure and chart the amount of blood withdrawn.

PHLEBOTOMY

Phlebotomy or venesection is the process of removing blood by opening a vein. It is a form of general depletion. It is not so frequently used as in olden times. It gives temporary relief at the expense of loss of food, oxygen, and protective bodies, etc., and is apt to lower the patient's strength and resistance. In certain critical conditions, however, it gives immediate relief and may be the means of saving the patient's life.

Conditions in which Phlebotomy is most Commonly Used:

1. In conditions of great venous engorgement as in uremia and in stenosis or regurgitation of the tricuspid valves. It is also used when the congestion is due to a weak heart, in order to lessen the work of the heart.
2. In diseases of the mitral valve with marked venous congestion.
3. In uremia and eclampsia with a high arterial blood-pressure.
4. In toxic conditions as in uremia and illuminating-gas poisoning, to remove the poisons. In these cases the blood withdrawn is usually replaced by a transfusion.

5. In pneumonia with pulmonary venous congestion and dilation of the right side of the heart.

Method of Procedure.—The above conditions indicate that the patient's condition is a serious one so that it is important to watch his color and pulse during and after the treatment. To lessen the danger the patient should be kept very quiet and in the recumbent position. The sight of blood is often alarming or nauseating to a patient, so it is wise to turn his head away. When advisable the nature of the treatment should be explained.

The nurse's duties consist in preparing for the treatment, watching and ministering to the patient, and assisting the doctor. Usually a tray containing the necessary articles for the treatment is kept in readiness in the wards. The sterile instruments required if they have to "cut down" to get into the vein, are an aneurysm needle, two hemostats, two pairs of forceps, scissors, scalpel, probe, needle with rubber tubing, needle holder and needles. The sterile sutures required are catgut, silk and horsehair; the sterile dressings necessary are sponges and gauze wipes. The dressing is held in place with adhesive. In addition a sterile glass graduate to receive the blood is required and sometimes a sterile salt solution is used to replace the blood withdrawn. When the blood withdrawn is thick and does not run easily a sterile syringe may be used to withdraw it. When the part is to be anesthetized, a sterile needle and hypodermic syringe loaded with cocain 2 per cent. will be required.

The bed under the arm is protected with a dressing rubber. A tourniquet is applied lightly around the upper arm, ready to be tightened, in order to increase venous pressure and make the vein prominent and distended. The vein from which the blood is usually withdrawn is the median basilic vein because it is the largest, most prominent and nearest the surface. When fastening the tourniquet, see that the loose ends point upward, away from the point of incision as the tourniquet is not sterile. The skin is cleansed and disinfected and the area surrounded with sterile towels. When the needle is inserted in the vein, the tourniquet is loosened to allow the free flow of blood. There are two methods of withdrawing blood. A cannula and trocar or needle with rubber tubing attached may be inserted into the distended vein. The tourniquet is then loosened and the trocar removed, allowing the blood to flow through the hollow cannula. No incision is made and no suturing, therefore, is necessary. Sometimes, however, in order to insert the needle, it is necessary to "cut down" on the vein, that is, to cut through the skin and fascia until the glistening wall of the vein is exposed. The resulting wound may have to be sutured. In either method the part is cleansed after the treatment with sterile salt solution and covered with a sterile wipe.

The amount of blood withdrawn is noted and recorded on the chart. Any change in the condition of the patient is also recorded.

PUNCTURE, INCISION, AND DRAINAGE

In certain diseases, fluid sometimes collects in various cavities and tissues of the body. This excess fluid may be the result of local inflammation, as in pleurisy with effusion, or of inflammation of an organ remote from the part where the fluid is collected, as in nephritis with general edema. It may also be the result of diseases of the circulatory system, either of the heart, blood vessels, or blood, which interfere with the normal circulation of the blood. It is frequently necessary to remove this excess fluid by artificial means.

The fluid withdrawn not only relieves the condition by relieving edema, tension, and pressure, and by improving the circulation, but it serves also as an aid in the diagnosis of the disease. The following are some of the means of withdrawing fluid from the body.

Lumbar Puncture

A lumbar puncture consists in the introduction of a suitable needle into the subarchnoid space of the spinal canal and the withdrawal of cerebrospinal fluid for diagnostic or therapeutic purposes. It also consists in the withdrawal of fluid for the purpose of injecting serum as a therapeutic measure and drugs to produce spinal anesthesia.

Anatomical and Physiological Factors to be Considered.—(From Woolsey.)—The brain and spinal cord are covered with serous membranes or meninges, the membranes of the spine being continuous with those of the brain. The tough fibrous dura consists of two layers, the outer of which is closely attached to the bony skull. The subdural space (a potential space) contains a small amount of fluid which prevents friction between the skull and the brain, serving the same purpose as the pleura and other serous membranes. The arachnoid, the middle layer, is very delicate and over the upper surface and sides is so closely attached to the inner layer or pia mater that they cannot be separated so is here spoken of as the pia-arachnoid. Over this portion, therefore, the subarachnoid space, though present, is not distinguishable. The arachnoid, however, does not dip in between the convolutions. The subarachnoid space over the posterior two-thirds of the base is quite large and contains the larger part of the cerebral cerebrospinal fluid which thus serves as a water cushion for the medulla and other important parts of the brain. The pia mater closely covers the brain, following all its convolutions.

The cerebral and spinal subarachnoid spaces and the fluid contained in them communicate freely with each other through the foramen magnum and with the cavity of the cerebral ventricles through the foramen of Magendie in the lower part of the roof of the fourth ventricle. The cord is suspended in cerebrospinal fluid. A lumbar puncture as a diagnostic or therapeutic measure depends upon this intercommunication and interchange of fluid.

Infection and inflammation of the meninges of the brain will quickly spread to those of the cord. The irritation and pain call forth an instinctive protective reaction so that the muscles contract, bowing the spine in the effort to protect and immobilize it. Inflammation of the meninges, like that of all serous membranes, results in increased secretion which, as it collects in a confined, bony cavity, gives rise to symptoms of pressure—headache, slow pulse, slow breathing and partial or complete unconsciousness.

This fluid or exudate will contain the products of the inflammatory process and the organism causing it. It may be so thick and abundant as to block the foramen of Magendie and interfere with the free intercommunication of fluid.

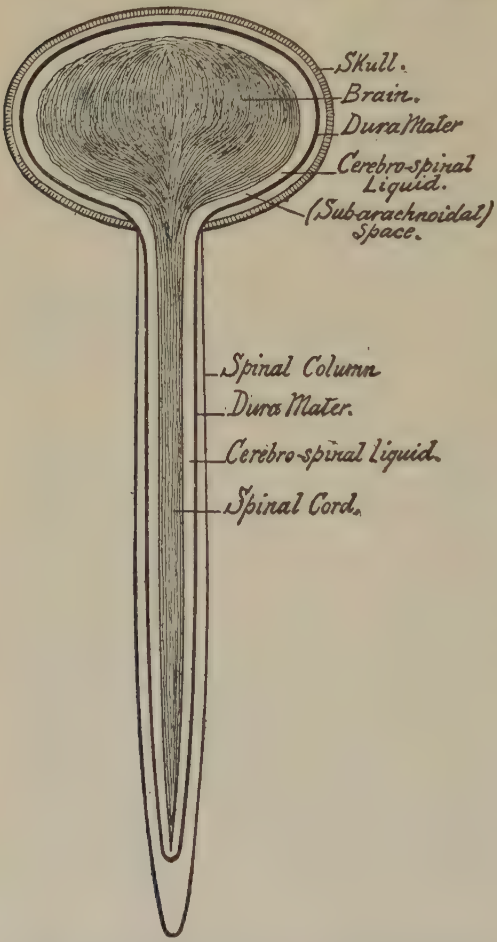

Fig. 120.—Diagram to Show the Connection of the Subarachnoidal Space in the Brain and the Cord. (From Howell's "Textbook of Physiology," W. B. Saunders Co., Publishers.)

Dangers involved in a Lumbar Puncture:

1. In operations or in a lumbar puncture, the drainage or escape of cerebrospinal fluid may be so great as to deprive the medulla of its water-cushion, causing it to rest directly on the

uneven bony surface of the skull. The resulting irritation may cause convulsions and may even interfere with the vital functions of the heart, respirations and vasomotor systems. There are reported cases of unconsciousness, death from respiratory paralysis, pain and partial paralysis resulting from this treatment.

2. A sudden fall in pressure may result in very dangerous circulatory disturbances which may prove fatal.
3. Injury to the spinal cord may result.
4. Infection may be carried in.
5. Injury to the cauda equina, shown by twitching of the muscles of the lower extremity, may occur.

Conditions and Purposes for which a Lumbar Puncture is Performed:

1. For a *Therapeutic Effect:*

(a) To relieve pressure in hydrocephalus, in tuberculous and syphilitic meningitis, in uremia, in convulsions in children and in epidemic meningitis due to the meningococcus.

(b) For the introduction of sera, as in the injection of tetanus antitoxin, anti-pneumococcus serum, and anti-meningitis serum.

In epidemic meningitis, sometimes the canal is drained, that is, the fluid is allowed to flow until the pressure is so reduced that only three or four drops come per minute. The canal is then irrigated by introducing the same amount of normal saline and again draining. Then anti-meningitis serum, warmed to body temperature, is injected *very slowly* under the least possible pressure. The dose of serum is usually 20 c.c. or a little less than the amount of fluid withdrawn, which may be 25 c.c. The dose may be repeated every twelve hours or even every eight hours, and is repeated until the spinal fluid is clear.

In syphilis involving the nervous system fluid is withdrawn for the purpose of injecting serum obtained from the blood after the patient has received an intravenous injection of 0.3 to 0.5 grams of salvarsan. An hour after the intravenous injection about 40 c.c. of blood are withdrawn and allowed to clot. It is placed on ice in a sterile container until the next day. The serum is then removed and heated in a water-bath at a temperature of 56° C. for one-half hour. Twelve c.c. of this serum diluted with 18 c.c. of normal saline solution (making a 40 per cent. solution) are injected into the spinal canal after withdrawal of the cerebrospinal fluid. This serum will contain a small amount of the salvarsan and specific antibodies to attack the *Spirochœta pallida* in the fluid and tissues of the brain and cord. This treatment is used in any syphilitic involvement of the nervous system —paresis, tabes, disseminated syphilis, syphilitic meningitis and Erbe's spastic paralysis.

2. For the *diagnosis* of meningitis, syphilis, intracranial pressure, and cerebral hemorrhage.

A lumbar puncture is *contraindicated* in a brain lesion or suspected brain tumor. If fluid is necessary for diagnosis not more than four to six c.c. are withdrawn and this is not done unless absolutely necessary.

Method of Procedure.—The treatment must be carried out with the strictest aseptic precautions. The doctor wears sterile gloves. All the articles used must be sterile. The *equipment* consists of a tray with the following: draping towels, sponges, iodin and alcohol for the skin, a hypodermic syringe and needle (length ¾ inches, gauge 25), to anesthetize the skin, and one for the deeper tissues (length 1 inch, gauge 24); two ampules of novocaine, with file, two lumbar puncture needles, three sterile test tubes marked for separate specimens of fluid, a sterile dressing and adhesive.

Sometimes a dry sterile aspirating syringe is required. The lumbar puncture needles selected vary in size, the length usually being three or three and one-half inches, and the gauge from 17 to 22. A small needle (gauge 22) with a round, sharp, tapering point is preferred by some doctors because it causes less injury and will bend before it will break, whereas the large needle (gauge 18) will break when bent and may cause injury to the spinal dura, allowing excessive leakage of cerebrospinal fluid with resulting headache from removal of the normal water cushion of the brain. It is recommended that needles be sharpened and polished each time before use. Other articles required will be an alcohol lamp, a fracture board, protection for the bed, and a chair (without arms) for the doctor.

The nurse is responsible for the care of the patient, for preparing and assisting the doctor with the treatment.

Preparation of the Patient.—As the patient must remain perfectly quiet and motionless during the treatment, it is very desirable to have his coöperation. When his condition permits, he should be told the nature and necessity of the treatment and of the slight pain usually involved, and also be reassured as to the absence of danger. The pain of the skin puncture and deeper tissues is prevented by a local anesthesia; the passage through the dura and the stretching of the periosteum sometimes cause considerable pain.

The *position* of the patient is important. It should be relaxed and comfortable. He should lie on his *left side* near the edge of the bed with his head and shoulders down and his knees drawn up as near as possible to his chin, so as to arch the back and separate the lumbar vertebræ.

The puncture into the subarachnoid space is usually made in the interspace between the third and fourth lumbar vertebræ or between the fourth and fifth lumbar vertebræ.

The upright position, with the patient leaning forward, his arms resting on a chair or bed rest, is sometimes used, but this position is said to be inadvisable because it is difficult to measure the pressure of the spinal fluid and sudden falls of pressure in the spinal canal, as previously stated, are likely to set up dangerous circulatory changes (Wood).

A fracture board is usually placed under the mattress to prevent sagging and maintain the same motionless position. The patient is protected with a treatment blanket; the bedclothes are turned down, and both are suitably arranged so as to expose the necessary area and, at the same time, protect the patient. The bed is protected.

The *skin,* cleansed and shaved if necessary, is carefully disinfected and the area draped with sterile towels.

Danger Symptoms.—The patient should be watched closely both during and after the treatment for any symptoms of pressure changes, such as changes in color, pulse, or respiration, and headache, nausea or vomiting.

After the treatment the fracture board is removed, the bedclothes are rearranged and the patient made comfortable. He should lie quietly in bed without pillows for at least twenty-four hours in order that equal pressure may be established in the cerebrospinal cavity and no unpleasant symptoms result from the procedure. He is usually given water to drink and light diet for the rest of the day.

The equipment should receive proper attention with special care of the needles.

Charting.—The amount and character of the fluid withdrawn—its color, whether cloudy or bloody—and whether it is withdrawn "under pressure," or not, should be charted. If blood is present note whether in all three tubes or merely in the first which occasionally happens from trauma. Any unpleasant symptoms should be carefully noted and charted.

The fluid is immediately sent to the laboratory, and put on ice to prevent changes in the character of its constituents. It must be carefully labeled with the name of the patient, the ward, what it is, and for what it is to be examined. Cerebrospinal fluid is usually examined for the white cell count, the differential white cell count, the butyric acid test, the Wassermann test, the colloidal gold test, and in some cases a bacteriological examination for the specific organism is required.

Examination of Cerebrospinal Fluid.—Normal spinal fluid is alkaline in reaction and has a specific gravity of from 1.005 to 1.010. The solids contained in it consist of a trace of protein (albumin), 0.05 per cent., white blood cells, 1 to 10 per c.m. and a small amount of sugar. Its pressure is sufficient to support 60 to 100 mm. of water, or to cause the fluid to flow through the needle at the rate of one or two drops per second. When the fluid flows more slowly it may be because the needle is not properly inserted, or because the exudate is too thick or purulent or because the intercommunication between the subarachnoid spaces of the brain and cord is shut off.

In inflammation of the meninges, an examination of the cerebrospinal fluid may show an increase in pressure, in specific gravity (due to increased solids), in the amount of protein, and in the number of white cells or leucocytes. It may also show an absence of sugar, and may show the specific organism causing the infection.

In meningitis, the intraspinal pressure may be very high (200 to 800 mm. of water) causing the fluid to flow more freely or even to come out in spurts. The white cell count may also be very high, often reaching several hundred per c.m. In syphilis the white cell count may be from 20 to 200 or more.

In tuberculous meningitis the fluid is usually clear. The differential leucocyte count shows an increase in lymphocytes: There may be 100 per cent. lymphocytes.

In acute meningitis, due to the meningococcus, the pneumococcus or streptococcus, the fluid may be cloudy, turbid, yellowish or greenish. The differential leucocyte count shows an increase in the polymorphonuclear white cells.

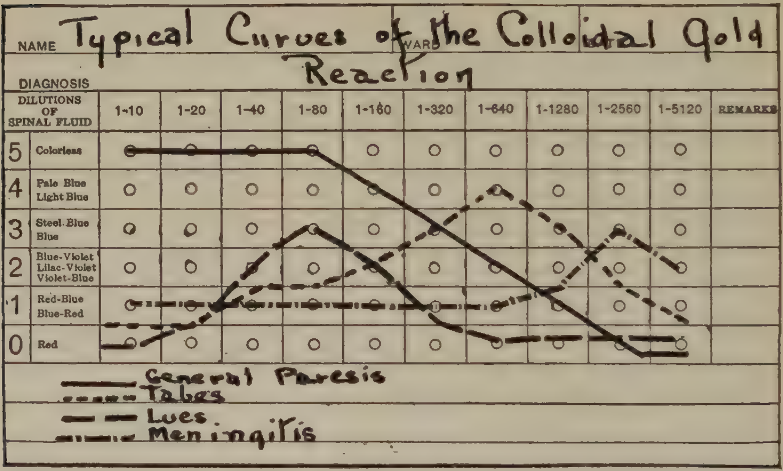

FIG. 121.—DIAGRAM OF CURVES AND THE PATHOLOGICAL CONDITIONS INDICATED BY THE COLLOIDAL GOLD TEST (St. Luke's Hospital, New York.)

The *butyric acid test* is used to determine the presence of increased protein or globulin. Globulin is not normally found in the spinal fluid. When present it indicates inflammation of the meninges. It does not explain the cause of the inflammation.

The *colloidal gold test* is based upon the fact that using colloidal gold as a reagent, the cerebrospinal fluid, in varying dilutions, will give a series of color changes according to the pathological condition present. The pathological conditions indicated may be general paresis, tabes dorsalis, syphilis, or meningitis. The diagram of curves in Figure 121 shows the possible color changes and the pathological condition indicated.

The *Wassermann test* is used as an aid to diagnosis in suspected syphilis involving the nervous system.

A Thoracic or Chest Aspiration

A chest or thoracic aspiration is the withdrawal of fluid from the pleural cavity.

The **treatment is indicated** when resolution or absorption of fluid fails to take place and when its accumulation causes pain, dyspnea and other symptoms of pressure. Failure of absorption may be due to the patient's condition or to the excessive amount of fluid. Frequently removal of part of the fluid is sufficient to enable the body to complete its absorption. For clinical purposes the fluid is classified according to its characteristics as either **a transudate** or an **exudate.**

A *transudate* (hydrothorax) may occur with general edema or dropsy due to heart, kidney, or hemic diseases such as the following:

1. Abnormal blood-pressure causing blood serum to pass out through the capillary walls into the tissue or lymph spaces, including that of the pleura. Edema or hydrothorax may be due to a high venous pressure and marked venous congestion resulting from valvular diseases of the heart such as mitral regurgitation or insufficiency. Relaxation of the arterial walls and a low arterial blood-pressure will also cause congestion and stasis of blood in the capillaries and the escape of serum into body cavities and tissues.
2. Changes in the capillary walls due to malnutrition or poisons, etc.
3. Changes in the quality of the blood.
4. Failure of the kidneys, in nephritis, to eliminate sodium chlorid causing the tissues to retain water in order to dilute and render them isotonic.
5. Failure of the kidneys to eliminate water as in partial or complete suppression.

Character of the Fluid.—A transudate is pale yellow or greenish in color, alkaline in reaction, and has a low specific gravity (below 1.015). It contains only a small amount of protein, a few leucocytes, and epithelial cells, and no bacteria.

An *exudate* may be due to:

1. Inflammation of the pleura—pleuritis or pleurisy. Pleurisy is usually due to infection by bacteria, the most common being the tubercle bacillus, the pneumococcus or streptococcus. The meningococcus has recently been found in the pleural exudate in pleurisy accompanying cerebrospinal meningitis. Sometimes the inflammation is due to a mixed infection.
2. Malignant growths.

Character of the Fluid.—An exudate is cloudy and yellowish in color, and alkaline in reaction. It has a higher specific gravity than a transudate (over 1.018), contains more protein and many epithelial cells. On standing a sediment forms. It will contain the organism (tubercle bacillus or pneumococcus, etc.) causing the inflammation.

In tuberculous pleurisy, the lymphocytes predominate; in pleurisy due to the pneumococcus, streptococcus, or meningococcus, the polymorphonuclears predominate.

The exudate may be serous, fibrinous or sero-fibrinous, hemorrhagic (in tuberculosis and from new growths), putrid (from malignant growths), or purulent. *A purulent exudate* or pus in the pleural cavity is called *empyema,* which is treated by incision and thorough drainage and not by aspiration.

Dangers Involved in a Chest Aspiration.—(1) Shock; (2) puncture of the intercostal or pulmonary blood vessels with a severe hemorrhage which may prove fatal; (3) puncture of the lung or of the diaphragm; (4) fatal syncope due to the withdrawal of fluid and the sudden relief of pressure on the heart, blood vessels and lungs, etc.; (5) convulsions have occurred, probably of reflex origin.

Important Factors to be Remembered in Giving the Treatment.—(1) That the treatment involves one of the vital organs, the function of which has been interfered with; (2) the proximity of the heart, the function of which may also have been interfered with; (3) the dangers involved; watch the patient's color, pulse and breathing. Watch for coughing (which may result from pricking the visceral layer of the pleura), or expectorating, and watch for any symptoms of syncope; (4) the danger of further infection or of forcing air into the pleural cavity.

Method of Procedure.—The nurse's duties are to prepare the articles necessary for the treatment, to prepare the patient, to watch him during the treatment, and to assist the doctor.

The required *articles* are a rubber sheet to protect the bed; sterile sheets to render the surrounding area sterile, alcohol or iodin and sterile cotton to disinfect the skin, a sterile hypodermic needle and syringe and cocain 2 per cent. for local anesthesia, sterile gloves and powder for the doctor, a sterile dressing and adhesive or a collodion dressing and the aspirating set. This consists of a graduated five- to eight-pint glass bottle provided with a rubber stopper in which there is a metal tube with two branches, each provided with stopcocks. To each branch is fitted a piece of rubber tubing provided with metallic ends. The sterile aspirating needle fits the metallic end of one piece of tubing and through the other air may be exhausted from the bottle, with an exhaust pump, leaving a vacuum in the bottle into which the chest fluid will readily flow. This suction is necessary because of the negative pressure (equal to fifteen to twenty pounds less than atmospheric pressure) in the thoracic cavity. This negative pressure is due to the elasticity of the lung tissue and the resistance it offers to the elevated ribs and the lung expansion. This downward pull of the elastic lung makes the atmospheric pressure greater than the pressure in the thoracic cavity and so the fluid cannot run out by gravity until the external pressure is made less than the internal thoracic pressure. This is done by creating a vacuum in the bottle so that the fluid is aspirated or drawn by suction. In the chest aspirations, also, there is little force from contracting muscles to aid in the flow of the fluid.

When the air is exhausted from the bottle both stopcocks must be closed, but before starting the preparation for the treatment the apparatus must be tested to be sure the chest fluid will flow into the bottle. You test the apparatus by placing the tubing, which is to be attached to the aspirating needle, into a glass of water and opening the stopcock of that branch only; if the water runs into the bottle readily, the chest fluid will also do so when the needle is inserted into the pleural cavity and attached to the tubing.

The *position* of the patient is important. To lessen the danger of shock, of fainting or of fatigue, it is wise to have the patient lie on his unaffected side in a semi-recumbent position, on the side of the bed most convenient for the doctor. The arm of the affected side may be held above the head or held forward with the hand on the opposite shoulder. The position must be comfortable, involving no strain or exertion. Frequently the treatment is given with the patient sitting on the side of the bed, his feet resting on a stool or rung of a chair, his arms resting on a pillow on the back of the chair. Sometimes it is given with the patient leaning forward on a bed tray. He should be warmly clad (that is, he should wear slippers and stockings and his body and lower extremities should be well wrapped in gray blankets) to prevent chilling and lessen the danger of shock. Only the necessary exposure should be permitted.

The *skin* where the puncture is to be made is disinfected. Punctures are usually made in one of the following spaces: (1) in the sixth or seventh interspace in the middle axillary line where the muscle is thin or (2) in the seventh or eighth interspace just outside the angle of the scapula.

As seen in the Figures 37 and 38, the lungs do not completely fill the pleural sac so that at the anterior and inferior borders, sinuses are formed. Pathological fluids first collect in the inferior or costo-phrenic sinus but may also collect in the interlobular spaces. The needle is injected midway between the ribs to avoid the intercostal blood vessels and during inspiration when the spaces are wider. The greatest precaution should be taken to prevent the entrance of infection or of air.

After the treatment the patient must remain quietly in bed, in the recumbent position and no exertion or sudden movements should be allowed. The sputum should be watched for the presence of blood. Blood in the sputum following a chest aspiration may result from injury to a blood vessel.

The amount, color and quality of fluid withdrawn, the time of the treatment and any symptoms of fatigue or syncope, etc., accompanying or following it should be charted.

The fluid is sent immediately to the laboratory to be examined for (1) specific gravity; (2) differential white cell count; (3)

the Esbach test; (4) the specific organisms present. The Esbach test is a quantitative test for albumin, the amount of which indicates the degree of inflammation present.

The bottle containing the fluid must be carefully labeled with the date, the patient's name, the ward, the nature of the fluid, and for what it is to be examined.

Aspiration of the Pericardium

Aspiration of the pericardium is the withdrawal of fluid from the pericardium by means of suction.

The treatment is indicated if "exploration" of the pericardium shows fluid to be present and when other means fail to cause its absorption, and the life of the patient is in danger.

Anatomical and Physiological Factors to be Considered.—(From Woolsey.)—The pericardium is a closed serous sac covering the heart. Its outer or parietal layer is reinforced by an outer fibrous layer, the elasticity of which allows it to be stretched to double its size. It is connected above with the respiratory muscles of the neck and with the diaphragm below so that during an inspiration (in which the ribs are elevated and the diaphragm contracted) the pericardium is pulled upon in both directions so that it is made tense and resists pressure made by the inflated lungs.

Normally only a few c.c. of clear citron-colored fluid are seen in the pericardium on post-mortem examination. In acute pericardial effusion, the parietal layer may be stretched so as to allow 12 to 18 ounces of fluid to accumulate, while in chronic cases, where the accumulation has been gradual and the parietal layer has had time to adapt itself, even three pints may collect without marked symptoms of distress.

The pericardium is pear-shaped, the base in contact with the diaphragm, the apex above. This is, therefore, the shape of the pericardial effusion. If the sac is only partly filled, the fluid may shift its position with that of the body so that when the patient is in the recumbent position the fluid may extend into the apex, press on the bronchi and interfere with the breathing. When the patient is sitting up the fluid gravitates to the base of the sac and the dyspnea is relieved.

When the accumulation of fluid is excessive, pressure is made on the heart, lungs, bronchi, trachea and esophagus, causing dyspnea, a dusky anxious countenance, a rapid weak pulse, a cough and dysphagia. The diaphragm, liver and stomach may be displaced downward.

Conditions in which Fluid may Collect.—Aspiration of the pericardium may be necessary to remove an exudate in pericarditis following rheumatism, acute tonsillitis, tuberculosis, scarlet fever, or pneumonia, etc., and to remove a transudate (hydropericardium) occurring in heart or kidney diseases with general dropsy.

The dangers involved in the treatment are injury to the heart or large blood vessels and shock and dilatation of the heart due to the sudden release of pressure.

Method of Procedure.—The *articles* required for the procedure are the same as in aspiration of the pleural sac except that, as the amount of fluid withdrawn is small, the aspirating set and large receptacle for the fluid are not usually required. A large sterile syringe is usually used to withdraw the fluid and a sterile test tube or larger glass to receive it.

The Position of the Patient.—The patient should be disturbed as little as possible. He must always be in the position in which he can breathe most easily. He is usually in great distress and his condition is most critical. His position should be made as comfortable and free from strain or exertion as possible, and as far as possible he should be freed from all mental distress or anxiety regarding his condition or the treatment.

The *area* where the incision or puncture is usually made may be the fourth, fifth, or sixth left intercostal space close to the left edge of the sternum, or the fourth or fifth right intercostal space, close to the sternum, where the distended pericardium also bulges. The skin is disinfected in the usual way with alcohol or iodin. The greatest precaution is taken to prevent the entrance of infection or of air.

The patient should be kept very quiet and closely watched during and after the procedure. The patient's critical condition and the dangers involved in the treatment should be constantly in the mind of the nurse. Any change in the rate or quality of the pulse, pallor, sighing, yawning, or coughing should be instantly noted and reported. A stimulant is usually kept at hand ready for instant use.

In charting the procedure, the amount, color and quantity of the fluid withdrawn, together with any symptoms of fatigue or syncope, etc., accompanying or following it, should be noted.

Abdominal Paracentesis

An abdominal aspiration is the removal of fluid from the peritoneal cavity. The condition is called ascites, from the Greek word meaning a skin-bottle.

Anatomical and Physiological Factors to be Considered.—(Woolsey.)—The peritoneal cavity is a closed serous sac except in the female where the openings of the Fallopian tubes connect it indirectly with the body surface. The parietal peritoneum, like that of the pericardium, is capable of great stretching, if it is gradual, and its elasticity allows it to return to normal when the cause of the stretching—a distended bowel, ascites, a pregnant uterus, an enlarged spleen, or tumors, etc.—is removed. Inflammation lessens both its elasticity and extensibility.

The peritoneal sac, like the pericardium, contains just enough fluid to lubricate its surface and to prevent friction between contiguous parts.

The peritoneum has an enormous surface, almost equal to that of the skin. Its power of absorption, therefore, is very great and, when irritated, the flow of lymph is reversed and an equal transudation or exudation may occur, according to the cause of the irritation. This explains the rapid and repeated accumulation of fluid or ascites in the peritoneal cavity. One patient I have known received 200 treatments in a period of four or five years, about thirteen quarts being removed at each tapping. This patient was obliged to sit up constantly and had constant difficulty in breathing. In another patient four and a half gallons accumulated without causing any difficulty in breathing, and the patient slept quite comfortably in the recumbent position. This fluid was removed at one tapping or paracentesis.

"There is normally a force in the peritoneal cavity which carries fluids and foreign particles toward the diaphragm, regardless of the position of the body, though either retarded or favored by it." The accumulation of a large amount of fluid may displace the diaphragm upward and greatly embarrass the work of the heart and lungs. When this is the case, Fowler's position is indicated to relieve the pressure on the diaphragm. In the case of a septic exudate this position is used to retard the flow toward the diaphragm where the absorption power is greatest and to cause it to gravitate to the pelvis where the infection may become localized and from where it may be drained.

The normal peritoneum can usually resist infection, but if irritated either by mechanical or chemical means it becomes much more susceptible to infection. The greatest aseptic precautions must be taken in this procedure.

Conditions Which May Cause Ascites.—An exudate may be due to (1) chronic inflammation from infection or peritonitis resulting from perforation or wounds of the viscera of the alimentary or urinary tract; (2) migration of bacteria through an inflamed intestinal wall; (3) infection from the Fallopian tubes; (4) infection from the blood or lymph stream as in tuberculous peritonitis or (5) infection from wounds of the abdominal wall.

A *transudate* or an *exudate* may be due to abdominal tumors, an enlarged spleen, cirrhosis of the liver, thrombus of the portal vein or general dropsy from cardiac, renal, or pulmonary diseases.

Dangers Involved in the Procedure:

1. Puncturing the bladder. This is easily avoided by emptying the bladder previous to the treatment.
2. Infection.
3. The sudden withdrawal of fluid reduces the intra-abdominal pressure and so causes a distention of the deep abdominal veins allowing the blood to collect in them and thus robbing the heart of its normal supply of blood. A fatal syncope may result or there may be a rapid outflow of fresh transudate from the lymph stream. This may be prevented by a gradual withdrawal of fluid and by external pressure made with an abdominal binder.

Usually only from one-half to three-quarters of the fluid is removed.

Method of Procedure.—*Preparation of the Patient.*—The patient is first allowed to void, or if necessary, is catheterized as the bladder must be empty. He is then brought close to the edge of the bed and comfortably supported in the sitting position with a backrest and pillows. His position should be free from all strain or exertion and as comfortable as possible. His chest should be warmly covered and only the necessary exposure of the abdomen allowed. Laparotomy stockings are always worn. Chilling and nervousness are both to be avoided as they increase the danger of shock. Reassure the patient and make the preparation as simple and unalarming as possible. Avoid unnecessary display of instruments to be used and turn the patient's head aside. He is less apt to be nervous if he has had previous treatments as he welcomes the relief which follows. During the treatment it is important to remember the dangers involved and to watch the patient's color, pulse and breathing, and for signs of syncope. A glass of ice-water and one-half ounce of whisky are usually brought to the bedside in case a stimulant should be required. An abdominal or scultetus binder is placed behind the patient ready to be fastened when required. Rubber dressing sheets are used to protect the bed and the patient.

The *incision* is usually made in the middle line of the abdomen one or two inches below the umbilicus. The middle line is chosen because an incision at the side might puncture the colon as it is fixed in position. The above area of skin is disinfected with alcohol or iodin and the part is surrounded with sterile towels.

The *articles* required for the treatment are rubber gloves and talcum powder for the doctor, hypodermic needle and syringe loaded with cocain two per cent., aspirating needle, cannula, trocar, and rubber tubing, large bottles or a pail to collect the fluid, sponges, dressings and adhesive plaster.

Usually a slight preliminary incision is made. For this a scalpel will be required in addition to the above. Sometimes one or two sutures may be necessary when the treatment is finished. For this you will require dressing forceps, needle holder, suture needles and sutures. All the instruments and other articles used must be sterile and the greatest precautions taken to prevent infection.

No aspirating apparatus is required for an abdominal paracentesis as suction is not required to remove the fluid. The fluid flows out impelled by gravity, the pressure of the viscera and the contraction of the abdominal walls.

A chair is usually provided for the doctor, as the treatment is prolonged.

The thickness of the dressing used will depend upon the case and the amount of drainage. The dressing should be watched for drainage, also the patient's condition following the treatment.

The amount and character of fluid withdrawn and any signs of syncope or change in the character of the pulse and breathing are charted.

ARTIFICIAL PNEUMOTHORAX

Pneumothorax means air in the pleural cavity. An artificial pneumothorax is the introduction of nitrogen gas or air rich in nitrogen into this cavity, for the purpose of creating sufficient pressure to collapse the lung and give it complete rest. This treatment, while performed by means of a puncture with a needle, is not for the purpose of depletion except in the sense that it depletes the space occupied by the lung.

The treatment is used in tuberculosis involving one lung only, where the lesions are fairly advanced and widespread and tend to break down, forming cavities. The complete rest gives the tissues a chance to heal and to check the process. It increases the resistance and greatly prolongs life. The cough and expectoration become less troublesome; hemorrhages are arrested and there is less absorption of toxins so that the systemic symptoms are also relieved. There is no discomfort or dyspnea when the uninvolved lung is able to compensate.

The treatment is *contraindicated* when the untreated lung cannot take up the work of the collapsed lung, and where pleural adhesions prevent the collapse of the lung.

The strictest aseptic measures must be observed.

Nitrogen gas is sometimes used because it is less readily absorbed than oxygen or air and so better maintains the pressure. Before injection, the gas is warmed to body temperature.

The patient lies on the unaffected side, the skin—usually in the mid-axillary line in the fifth or sixth intercostal space—is disinfected and the aspirating needle is inserted, moved up and down to be sure it is free and not in lung tissue, and the pure nitrogen or air rich in nitrogen is introduced up to a positive pressure of from 40 to 250 mm. The treatment is repeated usually on alternate days, until gradually the lung is completely collapsed. In most cases the pressure must be maintained over a period of months to enable the tissues to heal. The periods between treatments range from a few days to weeks depending upon the condition of the lung.

CHAPTER XXIII

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY GENERAL APPLICATIONS OF HEAT

General Hot Baths

Systemic Treatment.—Local applications of heat in the form of fomentations, poultices and local baths have been discussed in previous chapters. We now come to treatments in which heat is applied to the whole body, except the head, that is, to the systemic treatment of inflammation.

These treatments while not given directly, as in the local baths, to relieve inflammation and congestion, do relieve these conditions in an internal organ and other conditions which arise from them. For instance, a hot bath which increases perspiration and the elimination of waste products relieves an inflamed, congested kidney of work, and so prevents further injury and gives it a chance to recover from the damage already done. It also helps to remove the local inflammatory products. Drugs may be given for the same constitutional effect. Hot baths also give relief to other conditions to be mentioned in the present chapter.

General applications of heat are applied in the form of hot air, electric light, vapor, or water baths. Heliotherapy is an application not only of the heat rays but also of the ultraviolet rays of the sun.

Effects of a General Application of Heat.—The effects will depend upon the degree or intensity of heat, the duration, the type and method of application, and the condition of the patient.

A Neutral Bath.—Sedative and Quieting in Effect.—A bath at body temperature is called a neutral bath. It produces no marked changes in the body, but surrounds it with a medium which shields it from all external stimuli or irritation of nerve endings from air, clothing, pressure or changes in temperature, etc. The nerve endings are also said to imbibe water (either from direct absorption or from cessation of perspiration), and in this way their sensibility or irritability is blunted. As a result the nerve centers and the whole nervous system are allowed to rest. The neutral bath is therefore sedative and quieting in its effects and gives a chance for repair and the storage of vital energy.

Very hot brief general applications or baths produce first a **primary exciting effect** which is followed later by a **secondary exhausting effect.**

1. The *Primary Exciting Effect.*—The *primary or first effect* of a very hot bath is the *contraction* of all the superficial blood vessels. This causes a sudden inrush of blood (retrostasis) which is apt to be followed by a marked congestion of blood in the head. The contraction of so many blood vessels increases the resistance offered to the heart so that at first it is stimulated or forced to beat with greater force. The *pulse* at first will be increased in force and tension. This increased activity of the heart may add to the intense cerebral congestion. Heat also, at first, stimulates the heart reflexly by stimulating nerve endings in the skin. Heat stimulates the activities of all nerve cells, therefore it is *excitant* and may cause nervousness, headache and insomnia. In all hot baths, therefore, it is important to guard against *cerebral congestion* and to watch for symptoms of overstimulation shown by excitement, restlessness and a rapid pulse of poor force.

Heat *relaxes* and *restores* exhausted voluntary muscles after prolonged exercise by stimulating their nerve endings and by causing the more rapid elimination of fatigue products owing to the improved circulation. Heat at first *stimulates* the activities of all the body cells. It also *raises the body temperature* and this together with the increased cellular activity stimulates metabolism and the production of heat in the body.

2. The *Secondary Exhausting Effect.*—The *secondary effect* of a brief very hot bath is the result of the increased body temperature and excess heat production which immediately calls into play the heat-regulating centers. These centers check the production and increase the elimination of excess heat. *Perspiration* is increased and the *surface blood vessels are made to dilate* in order to increase the volume of blood in the skin and the loss of heat by both radiation and evaporation. The stimulated heart sends the blood more quickly through the dilated skin vessels so that it is more quickly cooled. The *pulse* is now frequent; the tension low. The increased volume of blood in the skin mechanically lessens the amount in internal organs. This may result in *anemia of the brain* and cause the patient to feel faint. The *respirations* are shallow but increased in rate in order to increase the loss of heat. The *body temperature* is now lowered; heat production is lessened, and all *cellular activity* is depressed. The result is muscular weakness, drowsiness, and depression of all the vital centers. During and after all hot baths patients should be watched closely for symptoms of depression. These are pallor, muscular weakness and lassitude, drowsiness and depression, a frequent, low-tension pulse and frequent shallow respirations.

The *exhausting effects* following general hot baths are said to be partly due to the fact that, while the activities of the body cells are at first stimulated, thus resulting in the accumulation of waste products, the oxidation of these waste products is diminished or checked in order to prevent excessive heat accumulation. The accumulation of waste products is shown by the increased elimination of nitrogenous wastes such as urea following the bath, while the diminished oxidation is shown by the lessened amount of carbon dioxid eliminated by the lungs. The waste products thus accumulate and cause depression and exhaustion similar to that from fatigue poisons.

This secondary effect which follows all hot general baths is called the *atonic reaction* because of the relaxed, dilated blood vessels, the frequent, low-tension pulse, the shallow rapid respirations, the muscular weakness, the depression of vital centers and the general exhaustion of the whole system.

Effects of Prolonged Hot General Baths:

1. *Moist Heat.*—Prolonged hot-water baths (even at body temperature) by preventing heat elimination and increasing heat production, cause a rise in body temperature. By a prolonged bath at a few degrees above body temperature, heat production and accumulation may be so increased as to become dangerous to life in a few minutes. This is because of the depression of the vital centers and the extreme muscular relaxation and prostration, including that of the heart and blood vessels, which follow.

2. *Dry Heat.*—Prolonged hot-air baths also increase heat production to a dangerous degree. They, however, allow for elimination of heat by evaporation. The skin tolerates a much higher temperature of dry heat than moist heat. The effect is not so intense as the moist baths because water is a better conductor and has a much greater power of absorbing and communicating heat than air. This explains why "heat stroke" is more common on hot "sticky" days. It also warns us, particularly in hot moist baths, to most carefully guard against both the primary excitant effects with overstimulation and the secondary depressing exhausting effects.

Precautions.—In all general applications of heat, cold applications should be made to the head before and during the treatment. The patient's pulse, breathing, color and expression should be watched very carefully. Water is usually given the patient to drink. It prevents thirst and adds to the patient's comfort. It aids diaphoresis and lessens the depression of the heart and body cells due to loss of fluid. Water is not usually given when the patient is edematous. Some doctors do not advise its use during the bath because they believe that it overloads the system with fluid, increases the volume of blood, the blood-pressure, and work of the heart, and that its elimination merely adds to the work of the kidneys and skin. In all hot baths every precaution should be taken to avoid burning the patient. All exertion must be avoided, and rest in the recumbent position for at least one hour following hot baths is essential.

GENERAL APPLICATIONS OF DRY HEAT

Hot-Air Bath

This consists in the exposure of the entire body, with the exception of the head, to a superheated atmosphere.

Conditions in which the Hot-Air Bath is Commonly Used:

1. In nephritis, to stimulate the skin and induce perspiration as a means of elimination.
2. In chronic rheumatism, to raise the body temperature and cause increased oxidation and elimination of proteid wastes.
3. In obesity, to cause increased oxidation of fats.
4. In sciatica and lumbago, to relieve pain and relax muscles.
5. As a preparation for general cold applications.

It is **Contraindicated:**

1. In eruptive skin diseases.
2. In febrile conditions.
3. In arteriosclerosis and advanced cardiac or nephritic diseases.

Effects Produced by Hot-Air Baths.—The effects are similar to those produced by the local hot-air bath, but are general. The temperature of the blood will be higher and perspiration more general and profuse. It is important to remember that, before perspiration begins and the surface vessels dilate, there may be marked cerebral congestion with headache, nausea and vertigo, a rapid pulse and short difficult respirations. The pulse should be watched carefully and the patient should be watched for symptoms of excitement and restlessness.

The above distressing symptoms may be prevented by applying cold to the head before the bath, by vigorous friction of the skin to hasten the dilatation of the surface vessels and by raising the temperature of the bath slowly until perspiration begins. Perspiration may be encouraged by making the patient drink a glass of water before the bath and encouraging him to drink one or two glasses during the treatment. Of course this rule does not apply in dropsical cases when the patient is on restricted fluids. Hot or cold drinks may be given as the patient prefers, but cold drinks contract the internal blood vessels, so tend to cause more blood to flow through the skin. They sometimes, however, cause chilling and have the opposite effect.

The normal rate of perspiration is one or one and one-half ounces per hour or two pints in twenty-four hours, but by hot applications this may be increased to more than an ounce a minute. It must be remembered that the loss of so much fluid from the body has a very depressing effect on the heart, similar to the effect caused by a hemorrhage. Copious drinking of water before and during the bath will increase the amount of perspiration and at the same time tend to prevent the very dangerous depression of the heart from loss of fluid. It also helps to prevent the tendency to constipation due to diminished intestinal secretions following the loss of so much fluid from the body.

Method of Procedure.—As in local hot-air baths, the method of procedure will depend somewhat upon the facilities or apparatus on hand.

Preparation of the Patient.—In a properly constructed cabinet, the patient, undressed, sits on a stool with the entire body enclosed except the head. The pulse should be taken before the bath, and, if allowed, a glass of water should be given. The face and neck should be bathed with cold water and cold applications should be applied to the head.

During the bath the patient should never be left alone. The pulse should be taken every few minutes. Fluids should be given if allowed and cold compresses kept on the head continuously. If there is a tendency toward cerebral congestion, a towel saturated with cold water may be applied around the neck. The applications must not be cold enough to check perspiration.

The *temperature* of the air is gradually raised to the desired degree in order to allow for the adjustment of the circulation in the viscera, otherwise anemia of the brain might cause the patient to faint. The desired temperature varies from 120° to 200° F.

The *duration* of the bath varies from twenty to thirty minutes.

Removal from the Bath.—During removal of the patient avoid exposure, and chilling. In rheumatism, cardiac and Bright's disease, chilling is particularly to be avoided. The patient should be wrapped in a warm blanket and allowed to cool off gradually until the skin is cool and the pulse normal.

If given to induce perspiration, the sweating may be continued by wrapping the patient in a warm blanket, and encouraging him to drink fluids. When the patient's condition will permit, some doctors follow this with a gradual cold application in the form of a spray, bath or cold sponge accompanied by rubbing. The temperature begins at 98° F., and is gradually reduced to 80° F. The duration is from one to two minutes only. The purpose of the cold application after the hot bath is to increase the tone of the blood vessels, to stimulate the nerve centers and to relieve the congestion of the skin. In all cases the patient should rest after the bath.

If the hot-air cabinet is not available, a satisfactory treatment may be given to the patient in bed by the use of cradles, extra blankets, and rubbers to keep in the heat, a bath thermometer, a heating apparatus such as an alcohol lamp and a pipe protected by asbestos to conduct the heated air. In this case, in addition to the precautions previously mentioned, special care must be taken to secure the desired temperature, to prevent loss of heat, and to avoid burning the patient or the clothing.

The frequent use of hot baths is to be avoided as they are weakening and may cause nervous exhaustion and debility.

LIGHT BATHS

Light baths may be applied by means of heliotherapy or by electric light rays.

1. **Heliotherapy.**—The stimulating effect of the sun's rays on the growth of plants is, of course, well known. Plants show their vital need of sunlight by always turning toward it, its absence causing them to be pale, weak and sickly.

The sun's rays have the same stimulating effect upon the cells of our bodies as upon the cells of plants. "Put the pale withering plant and human being into the sun, and, if not too far gone, each will recover health and spirit." If deprived of sunlight both children and adults become pale, sickly and stunted in both mind and body. Florence Nightingale, with her usual keen observation and grasp of fundamental facts, noted that patients always turn with their faces toward the light. This vitalizing and healing power of the sun's rays has been recognized and utilized in the treatment of the sick from the most ancient times. They not only stimulate the circulation and all the activities of the skin but indirectly affect the innermost parts of the body, vitalizing, restoring and promoting the vital activities of every tissue.

The power of the sun's rays to wither and destroy plants is also well known. If in excess, they have the same power to destroy our tissues as may be seen in a sunburn and heat-stroke.

The sun's rays consist of light waves of varying lengths which may be classified according to the wave lengths into infra-red rays (the longest waves), visible rays, and the ultra-violet rays (the shortest waves). From a therapeutic standpoint these may be classified into, (1) heat rays; (2) luminous rays; and (3) actinic or chemical rays.

Therapeutic Action of Light.—While the value of these rays is recognized as a therapeutic measure their use and method of application have not as yet been entirely developed on a scientific basis. For instance, it is known that the curative effect of exposure to the sun's rays in *rickets* is due to the ultra-violet rays; while in *tuberculosis* and other conditions the particular waves to which the beneficial effects are due are not definitely known. The treatment in such diseases, therefore, consists in exposure to all the rays, that is, to heliotherapy. It is known that, while the infra-red rays heat the skin surface and the visible rays penetrate the skin and heat the blood and subcutaneous tissue, the ultra-violet rays penetrate little; and it is generally believed that, in tuberculosis, the beneficial effect is due, not to any local action, but to the general effect on the skin which indirectly affects the disease. The beneficial effects are in direct proportion to the extent of skin area exposed. Local applications to lesions are considered harmful, and sinuses, infected glands, and superficial abscesses are covered and protected to prevent them from breaking down and thus, also, from exposure to secondary infection.

Method of Application.—The sensitivity of patients to light and the possible dangers of over-exposure have been mentioned. The *symptoms* of over-exposure are headache, fever, and, in severe cases, vomiting, diarrhea, and symptoms of shock. To avoid this patients are exposed gradually, increasing the time and area exposed each day by a method called zoning. The head is never exposed but eyes and head are protected. The genitals are also covered as the skin is thin and easily burned. In treating children and incontinent patients the buttocks are also covered because the skin, irritated by urine, is easily burned, and scalded by heat and moisture. In the presence of fever (100° F. or over), vomiting or diarrhea, the treatment is omitted.

Preparation of the Patient.—The patient is prepared in the ward by covering him with a treatment blanket, folding the bedclothes to the foot of the bed, and removing the gown. For adults, the genitals are covered with trunks, and for children, with a binder or gauze pad fastened with adhesive. The head is covered and, during the treatment, remains in the shade while the proper area is exposed to the sun. The patients should be protected from winds, cold and chilling. They should be watched closely during the treatment, especially children, and nothing, except symptoms of over-exposure, allowed to interfere with the proper time and area of exposure. No visitors are permitted. When the treatment is completed the bedclothes are neatly replaced and the patient is returned to the ward. Trunks, etc. are removed, the gown is put on, the patient is made comfortable, the blanket is neatly folded and put in its proper place. If the patient shows signs of overheating, an alcohol sponge is given.

The *duration* of the treatment varies, increasing gradually each day in accordance with the heliotherapy régime until the *maximum* of 90 minutes general exposure twice daily (anterior in the morning and posterior in the afternoon) is reached. Beyond this time results in the enervating, exhausting effects of prolonged applications of heat instead of the stimulating effects desired. When the radiation (found by substracting the temperature in the shade from the temperature in the sun) is over 20, the time of exposure is cut to two-thirds of the time a patient would, according to the régime, be receiving.

Charting.—Accurate, complete records, promptly charted, should be kept on the special charts usually provided. The patient's condition, especially those symptoms related to the treatment mentioned above, and a complete record of the treatment—the time, duration, intensity, radiation, zone treated, symptoms and results observed, and the attitude, response and conduct of the patient—should be carefully noted.

2. Electric Light Rays.—Electric rays closely resemble the sun's rays both in their stimulating and destructive effects. They are, therefore, used as a substitute. By their means plants are made to grow night and day during either winter or summer, and electric baths are a convenient means of applying radiant energy to the body.

Electric light may be in the form of either the *electric-arc light,* or the *incandescent light.*

The electric-are light contains luminous rays, heat rays and actinic or chemical rays in even larger proportion than the rays of sunlight. These rays may be separated by allowing the sunlight or electric light to pass through different colored glasses.

Red glass allows the heat rays to pass through.

Blue glass allows the actinic or chemical rays to pass through.

Yellow glass allows the luminous rays to pass through, and to a slight extent also the heat and chemical rays.

The electric-arc light, containing, as it does, rays similar to sunlight, is used as a substitute for sunlight on cloudy, cold, rainy days in the treatment of tuberculosis, and has been found to be an excellent substitute in stimulating the growth and vitality of all forms of animal or vegetable life. While not definitely known, it is thought that the marvelous vitalizing power of sunlight, also its harmful effects seen in "heat-strokes" and the so-called sunburn, are due to the excessive action of the actinic or chemical rays and not to the heat rays.

The incandescent light contains luminous rays and heat rays and is the form of application most extensively used as a thermic agent.

The **quartz mercury vapor lamp** is used for the application of the ultraviolet rays. Quartz permits the passage of the ultraviolet rays but few of the heat rays, so the treatment is not an application of heat.

Physiological Action.—Ultraviolet rays have little power of penetration so do not *directly* affect deeper tissues. They are absorbed by surface cells of tissues and produce a powerful biological action on the cells and indirectly stimulate all the cells of the body. *Locally* the rays usually produce no heat or perspiration but, being absorbed, cause a marked chemical reaction in the skin with pigment formation, and possibly erythema or sunburn up to a first degree burn. They penetrate little because absorbed by the hemoglobin which acts as a red filter screen. They are absorbed by the blood and produce a marked chemical reaction. The *general effect* is increased hemoglobin, red cells, lymphocytes, and platelets; increased metabolism, bone formation, elimination of wastes, and resistance to disease; and a sedative effect, relieving spasms, pain, and inducing sleep.

Therapeutic Uses.—Their most useful function is said to be their power to increase the absorption of calcium and phosphorus and to thus insure better nutrition of bones and of the nervous system. They are used in rickets, bone and joint diseases, neuritis, lumbago, anemia, malnutrition, sinusitis, in some cases of tuberculosis, to relieve dyspnea, and asphyxia in asthma, and to produce the above general effects.

The *precautions* in using are indicated by the physiological action given above and are much the same as in the use of heliotherapy, light and heat baths in general. Special emphasis is placed on the protection of the eyes of both patient and nurse, the danger of over-exposure and burning, the necessity of close observation, accuracy in carrying out prescribed treatments, in charting results, and in the general care and use of the very costly lamp apparatus.

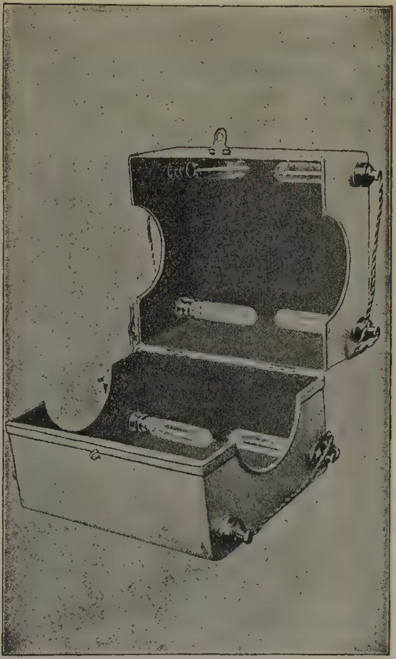

FIG. 122.—ELECTRIC-LIGHT BATH FOR JOINT. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

THE INCANDESCENT LIGHT BATH

Effects of the Light Bath.—The electric-light bath is a source of radiant energy, and as such is superior to all other thermic agents previously studied, possessing the following advantages:

1. The heat rays only manifest the heat when they come in contact with objects which offer resistance to their passage. Air offers no resistance, the skin very little, so that the radiant energy penetrates directly to the deeper tissues without heating the surrounding air. In the hot-air baths, the heat is carried by conduction by the heated air and very slowly penetrates the skin.

2. The skin, tissues and blood are heated more quickly, the sweat glands are stimulated, perspiration is more profuse, occurs in less time and in a surrounding medium at body temperature.

3. The effect does not depend upon heated air, therefore the patient need not be confined or subjected to the depressing effect of hot air. He can thus be made more comfortable.

4. The air around the patient not being heated, heat elimination is greatly increased. If desired, the effects of hot air and radiant energy may be combined by giving the bath in an enclosed cabinet, in which the heated globes soon heat the air.

5. The application can be made to any part of the body with greater ease and rapidity. The exact dosage can be regulated both as regards time and intensity.

6. The skin is stimulated, a strong tonic effect is produced on the tissues at the same time elimination of waste products is stimulated. Carbon dioxid is eliminated by the lungs to a greater degree, showing increased oxidation, therefore the bath must not be prolonged.

7. The electric-light bath is a much more rapid and satisfactory means of preparing the skin for cold applications without overheating or relaxing to a great degree the superficial blood vessels.

Purposes for which Light Baths are most Commonly Used:

1. To relieve internal congestion and pain by increasing the volume of blood in the skin.
2. To promote the absorption of inflammatory products and the formation of new tissue in the treatment of wounds, cellulitis, ostemyelitis, pleurisy and pneumonia.
3. As a tonic to the skin and tissues.
4. To stimulate elimination by the skin without prolonged exhausting measures in the dropsy of cardiac or Bright's disease and in toxemia.
5. To elevate quickly the body temperature when lowered

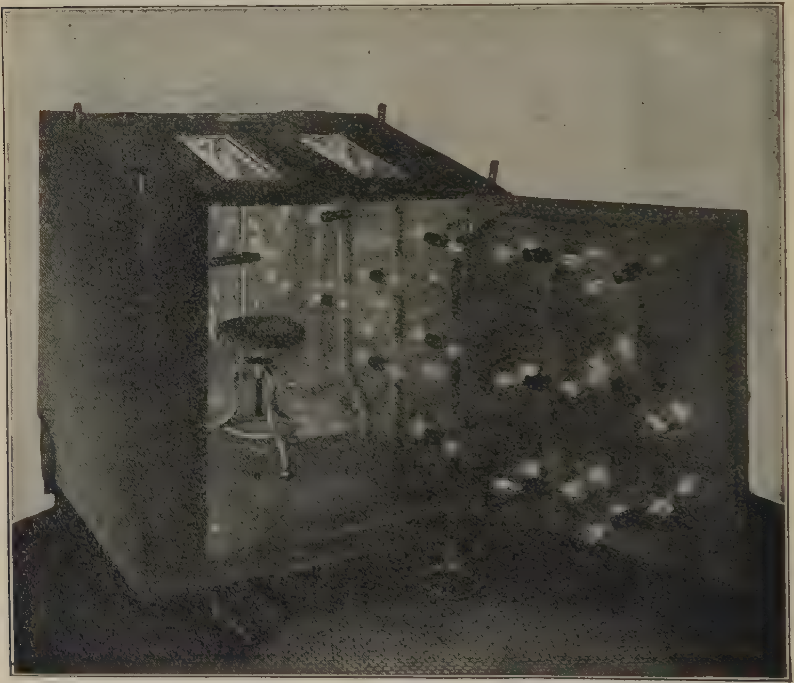

Fig. 1223.—Electric-light Bath Cabinet. (From Hare's "Practical Thesapeutics," Lea and Febiger, Publishers.)

from any cause and as a ready preparation for cold applications.

6. For all purposes and conditions for which general or local applications of heat are applicable.

The electric-arc light is a powerful nerve tonic in the treatment of various nervous diseases. It also destroys the bacillus of tuberculosis in the skin and is a curative measure in the treatment of lupus.

Method of Procedure.—As the incandescent-light bath is essentially an application of heat, the precautions will be the same as those previously outlined. In addition, it must be remembered that prolonged applications to a greater degree may cause increased oxidation and an increase in body temperature to a dangerous degree.

Figure 122 shows a form of apparatus used for local applications, and Figure 123 shows the electric-light cabinet used for general applications. Modifications of these are easily constructed by means of lights suspended from cradles.

The *duration* of local applications is usually from fifteen to thirty minutes. The duration of general applications depends upon the object. It may be from three to five minutes, or when for eliminative effects, from fifteen to twenty minutes. A longer application may cause exhaustion from excessive elevation of body temperature and overstimulation of the nervous system.

GENERL APPLICATIONS OF MOIST HEAT

The Vapor Bath

The method of administering the vapor bath is the same as that of the hot-air bath except that the patient is surrounded by vapor or moist air instead of dry air, so that, if given in bed, extra rubbers will be needed to protect the bed.

Effects of the Vapor Bath.—The effects are the same as those attributed to the hot-air bath, but are very much more intensified as shown in the following results:

1. The body temperature is increased more rapidly, and to a greater degree.
2. The oxidation of protein is greatly increased, therefore it is useful in gout, rheumatism, etc., when oxidation of protein wastes is incomplete.
3. The pulse is more rapid, blood-pressure lower and the heart quickly tires out.
4. Respirations are also rapid but not in proportion to the pulse so that the tissues lack oxygen.
5. Perspiration is more rapid and profuse.

The **vapor bath is used** as a therapeutic measure in the treatment of the same conditions as those mentioned under the hot-air bath.

The *temperature* of the vapor bath varies from 120° to 130° F.

The *duration* of the bath when used as a preparation for a cold bath varies from 3 to 5 minutes and when used to increase eliminations from 15 to 30 minutes.

The principles underlying the procedure and the precautions to be observed are the same as in the hot-air bath, but as the vapor bath is much more vigorous and exhausting, therefore more dangerous, the patient must be watched more closely.

THE HOT PACK

This treatment consists in wrapping the body of the patient in a blanket wrung out of water as hot as can be endured by the patient without pain or injury.

The **effects of a hot pack** are essentially the same as those of the vapor bath.

1. It communicates heat to the body, prevents heat elimination, raises the body temperature and induces perspiration. It increases the elimination of proteid ashes as the odor of urine on the blankets in some cases testifies. In this way it rests the kidneys.
2. It is highly exciting, increases the pulse rate and may cause congestion of the viscera, especially of the brain.
3. As in all hot applications, it is followed by an atonic reaction so that the blood vessels are relaxed and dilated and the arterial tension is lowered. Frequent treatments weaken the circulation, lower the resistance and depress all the vital activities.

Conditions in which a Hot Pack is most Commonly Used:

The treatment is not usually ordered more frequently than is necessary because of its depressing effects, but may be ordered in any disease accompanied by symptoms of suppression. These are acute Bright's disease, uremic poisoning, bichlorid of mercury poisoning, cardionephritis, and in the albuminuria of pregnancy and eclampsia.

The *results desired* are to induce perspiration, to relieve edema, to eliminate waste products not eliminated by the kidneys and to lower arterial tension.

Method of Procedure.—There should be two people, if possible, to give this treatment in order that it may be given as quickly and skilfully as possible without exposing or tiring the patient.

Preparation of the Patient.—The bed is usually protected by a large rubber covered with a dry blanket. The patient is covered with a second dry blanket and the upper bedclothes are turned down. The patient's gown is removed so that he lies between dry blankets. Cold applications are made to the head, water is given to drink, if allowed, and the pulse is taken.

The *method of applying the wet blanket* and the temperature of the water in which it is wrung differ in different hospitals. Sometimes, to avoid burning the patient, a dry blanket is first wrapped around the body and limbs, the wet blanket not being allowed to come in contact with the skin. The blanket is then wrung out of boiling water. In other hospitals the hot wet blanket is applied directly to the patient's skin. The blanket in this case will be wrung out of water at 150° F., that is, as hot as the patient can comfortably stand. Whatever method is used every precaution must be taken to avoid burning the patient. The blankets must be wrung as dry as possible. They should be kept hot while being carried to the bedside and applied at the right temperature. Special care must be taken to avoid burning the patient when the tissues are edematous. The wet blanket should be wrapped snugly around the patient in close contact with the whole body surface and so that no two surfaces of skin are in contact. If hot-water bags are used to maintain the heat they must never be allowed to come in contact with the wet blanket, but must be placed outside the dry blankets to prevent scalding the patient. The dry blankets and rubber are also wrapped snugly around the patient, particularly at the neck. A towel should be placed between the blankets and the face and neck of the patient. All blankets must be smooth and comfortable when applied, with no wrinkles or bulky places especially under the patient. The upper bedclothes are replaced during the treatment.

During the treatment the pulse should be watched carefully. Fluids should be given to drink if allowed, and cold should be applied to the head continuously.

Duration of the Pack.—The patient is usually left in the wet blanket for twenty minutes, unless symptoms arising prevent. After the removal of the wet blanket the patient is usually left wrapped in the dry blanket for from one-half to one hour.

Before the removal of the dry blanket the patient should be dried carefully with a heated towel and may be rubbed with warm alcohol but not vigorously enough to cause continued perspiration. A warm gown is then applied. The blanket is removed; the bedclothes are rearranged and the patient is made comfortable. There should be no exposure throughout the whole procedure. Some doctors require the patient's temperature to be taken before, during and after the treatment.

THE HOT-TUB BATH

Conditions in which the Hot-Tub Bath is most Commonly Used:

1. In dropsy due to cardiac diseases, if cyanosis is not present. (Cyanosis indicates loss of tone in the muscles of the heart and blood vessels, which would be further lessened by a hot bath.)

2. In dropsy due to acute nephritis following scarlet fever or diphtheria.

3. In colds to absorb or break up a cold. Applications which cause increased perspiration also cause increased activity of mucous membranes.

4. In threatened uremic convulsions to abort an attack.
5. In infantile convulsions and in asphyxia of the newborn.
6. In gall stones, gastric, intestinal or renal colic and in cystitis to relieve pain.
7. In suppressed menstruation.
8. In chronic or muscular rheumatism and obesity.
9. In icterus or jaundice, to relieve the itching and aid in the elimination of the bile-pigments from the tissues.
10. In the beginning of measles or scarlet fever to encourage the development of the eruption.

The Bath is Contraindicated:

1. In cardiac weakness because of its weakening effect.
2. In organic diseases of the brain or cord because of both its excitant and depressing effects.
3. In arteriosclerosis and threatened apoplexy on account of the danger of cerebral congestion and the rupture of a blood vessel.
4. In febrile conditions to avoid an increase in temperature.

The *temperature* of the bath varies from 98° to 104° F. or 110° to 112° F., according to the condition of the patient and the effect desired.

The *duration* of the bath varies from two to thirty minutes. A temperature of 110° F. should never last more than from ten to fifteen minutes.

The principles underlying the procedure and the precautions to be observed are the same as in all general applications of heat.

The Sedative Bath

The sedative bath consists in a full tub bath at a temperature varying from 92° to 97° F. It is often called a neutral bath because given at about the same temperature as that of the skin, which is, on an average, about 92° F.

Effects of the Bath.—Neither thermic nor circulatory reactions follow when the temperature of the bath is neutral so that there is no change in the pulse or body temperature. At the neutral temperature, as explained in the action of heat, the nerve endings in the skin imbibe water, probably from the retained perspiration which is not excreted, and this greatly dulls their sensibility. The whole nervous system is thus protected from all irritation from external sources so that the bath is soothing and sedative. Although the surface temperature may be lowered, it is said that there is no increase in heat production (by the contraction of muscles), but rather a decrease. This is because there is no stimulus or irritation of thermic nerves (the hot and cold spots in the skin), and therefore no stimulation of the heat-producing centers. For this reason it is essential that the patient should rest and be properly covered after the bath to prevent further loss of heat and chilling.

The kidneys are stimulated and secrete more urine after the bath.

Conditions in which the Sedative Bath is Used:

1. In insomnia.
2. In the treatment of drug addicts.
3. In disorders of the nervous system.
4. In diseases of the heart and blood vessels in which very hot or cold applications must be avoided because of the extra strain put upon the heart and blood vessels.

The duration of the bath varies from fifteen minutes to one hour. The good effects of the bath depend upon the maintenance of the proper temperature. In giving the bath it is, therefore, most important to see that the neutral temperature is maintained.

The best time for taking the bath is just before bedtime when sleep is desired. In this way the necessary rest following the bath is secured and loss of heat and chilling are avoided.

THE CONTINUOUS BATH

The neutral bath may be continued for weeks or months. It is then called a continuous bath.

Conditions in which a Continuous Bath is most Commonly Used:

1. In inflammatory conditions of the brain and cord, such as meningitis, chorea, delirium, hysteria, neurasthenia and mania.
2. In certain forms of skin diseases.
3. In septic cases or badly infected wounds.
4. In extensive burns or bedsores.

Results of the Continuous Bath.—The sedative effect on the nervous system is the same as in the sedative bath. In such conditions as extensive burns, bedsores or infected wounds it keeps the parts clean, lessens pain, fever and suppuration. It keeps the inflammatory products washed away so that there is less toxemia from absorption and less irritation of the liver and kidneys from overwork and the handling of increased waste and toxic products. The healing process is stimulated and the nervous system is soothed and rested.

Method of Procedure.—The bath must be so arranged that the patient will rest comfortably supported on a hammock or other support with the whole body completely immersed except the head. The head should rest comfortably on a rubber pillow. A patient must be watched very closely when in the bath and special care is necessary to see that the neutral temperature is maintained. The patient's skin should be rubbed with vaseline at least once a day to prevent the effects of maceration. A patient is raised out of the bath to empty the bladder or bowels. The water of the bath should be changed at least every twelve hours and the tub thoroughly cleansed. In a hydrotherapeutic department there are special tubs in which provision is made for a constant removal of water and a fresh supply at the right temperature. During the treatment the tub is always properly covered so that there is no exposure of the patient. When removing the patient from the bath for any purpose no exposure should be allowed. Special care must be taken to prevent chilling on account of the lessened amount of heat produced in the body.

CHAPTER XXIV

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY LOCAL AND GENERAL APPLICATIONS OF COLD

Some of the uses, and the effects of *local cold applications* and the forms in which they may be applied have been discussed in a previous chapter. We now come to the study of *local applications* more commonly used for those acutely ill, and to the study of general applications of cold to the body in the form of cold packs, sedative packs, cold tub baths, cold sponge, and slush baths.

Cold applications are used in a great variety of conditions, medical and surgical, and frequently for patients acutely ill. The physiological action of cold, the uses and effects of local applications, if studied in a previous chapter, should be thoroughly reviewed, in the light of, and enriched by, the students' clinical experience, before studying the following treatments. A thorough understanding of the local effect is basic to an understanding of the general effects.

Local applications of cold are made by means of an ice-bag, an ice-coil, cold compresses or volatile sprays. They are used in the treatment of both medical and surgical diseases. The application of an ice-bag, and cold compresses to the head have been discussed in Chapter XVI.

The Ice-Coil

The ice-coil is a convenient substitute for the ice-bag when cold is to be applied continuously. It is lighter, more pliable, may be more easily fitted to the part and the temperature can be kept constant. It consists of a flat coil of rubber tubing, with two loose ends about two yards long, through which cold water is passed.

Conditions in which the Ice-Coil is most Commonly used:

1. Applied to the head in fevers, meningitis, cerebral hemorrhage and conditions accompanied by cerebral congestion to contract the blood vessels, check bleeding, inflammation and congestion, and to act as a sedative in delirium.
2. Applied to the chest in hemoptysis, pleurisy and pneumonia to check bleeding, inflammation, and congestion; to relieve pain, dyspnea and coughing, and to calm an irritable heart and slow

the pulse in pneumonia. The cold increases the tone in the muscles of the heart and blood vessels, and improves the circulation. It increases leucocytosis, the elimination of toxins and vital resistance in the part. It stimulates vital nerve centers, relieves toxemia, and lowers the temperature. It induces sleep, improves the appetite, and the function of the kidneys.

3. Applied to the left side of the chest in endocarditis, in pericarditis, and in fevers, such as typhoid and pneumonia, with a rapid, bounding pulse.

4. Applied to the abdomen in typhoid fever to cause the continuous contraction of the mesenteric blood vessels and prevent or control hemorrhage and congestion and the action of bacteria. It increases vital resistance in the part. It also keeps up the tone and contracts the muscles of the intestines and prevents distention.

Method of Application.—When an ice-coil is to be applied a bucket containing water and ice is placed on a chair or stand at the side of the bed. The ice should be covered with gauze to prevent any particles from the melting ice from clogging the tubing. A second bucket or pail is placed on the floor or on a low stool for the return flow. The air may be expelled and suction created in the tubing by first attaching a funnel to the end through which the water enters and pouring water through. Before it has all quite run through, the end of the tube should be placed in the water in the bucket on the stand. The ice water should then run continuously. The water in the pail on the floor may be poured back into the bucket and kept at the right temperature by adding ice to it. Sometimes instead of a bucket and flow of water by siphonage, a water cooler is used from which water flows by gravity.

Preparation of the Patient.—As in all cold applications, the patient's feet and body must be warm and the application must not be allowed to cause prolonged chilly sensations. The area to which the cold is applied should be warm before the application is made. To protect the skin from the intense cold, a moist compress is placed between it and the coil. The skin must be closely watched for discoloration and numbness.

THE COLD COMPRESS

Cold compresses may be applied to the head, chest or abdomen in the same conditions and for the same purpose as the ice-coil.

COLD CHEST COMPRESS

The cold compress to the chest may be used for the same purposes and in the same conditions as the ice-coil, but is most commonly used in pneumonia.

The **purpose of the application** is (1) to improve the circulation and increase vital resistance in the lungs; (2) to relieve pain, dyspnea and coughing; (3) to improve the tone of the muscles of the heart and blood vessels; (4) to stimulate the

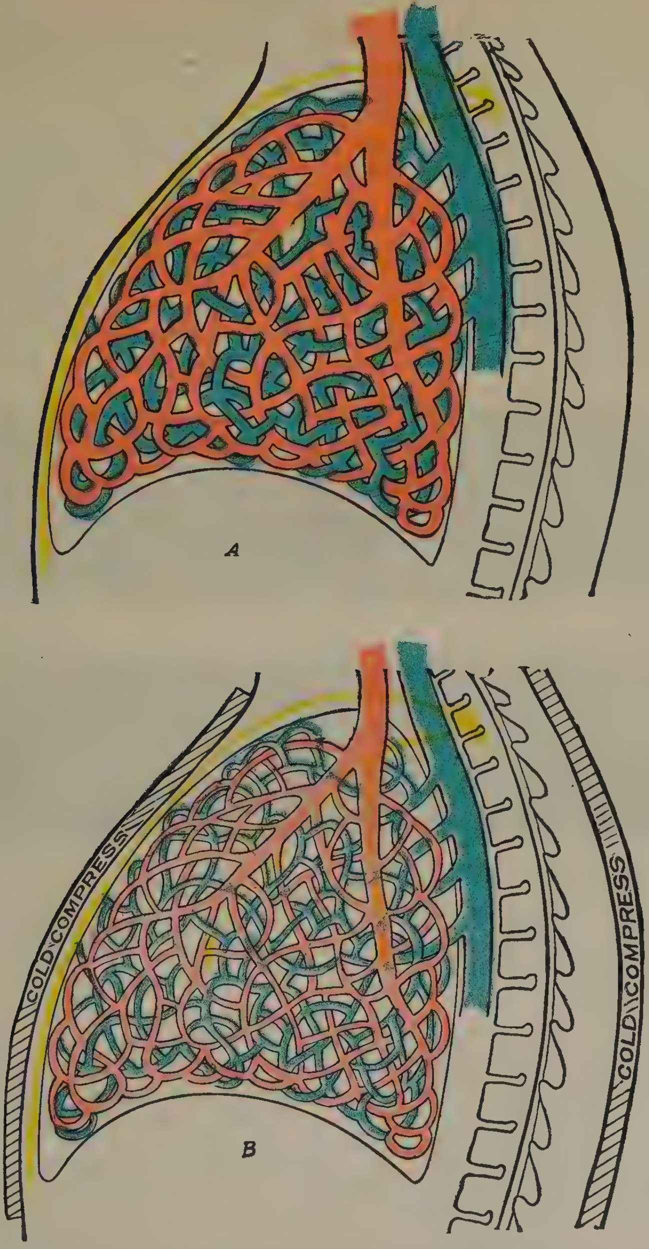
A
COLD COMPRESS
COLD COMPRESS
B

FIG. 124.—DIAGRAMS SHOWING: A, PULMONARY CONGESTION; B, BENEFICIAL EFFECT OF COLD CHEST COMPRESS. (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

vital nerve centers, to relieve toxemia, to lower the temperature and to induce sleep; (5) to improve the appetite and the function of the kidneys and other organs.

Method of Application.—The *compress* usually consists of about three layers of folds of old linen. The thickness must be sufficient to retain the moisture. It is cut and shaped so as to snugly fit the area to be covered. The method used sometimes calls for a piece of thin, soft, closely woven flannel, cut the same shape, but about one inch wider and longer to cover the wet compress. Two such compresses and flannels will be required so that when changing the application the fresh compress may be applied quickly and without exposure of the part. Exposure allows evaporation, chills the part and interferes with the desired reaction. Two sets are also necessary to allow the compresses to be washed and boiled at least once in twenty-four hours. This is essential for cleanliness and to prevent the possible danger of infections such as furuncles. Compresses are always thoroughly rinsed in a second basin of water before re-applying.

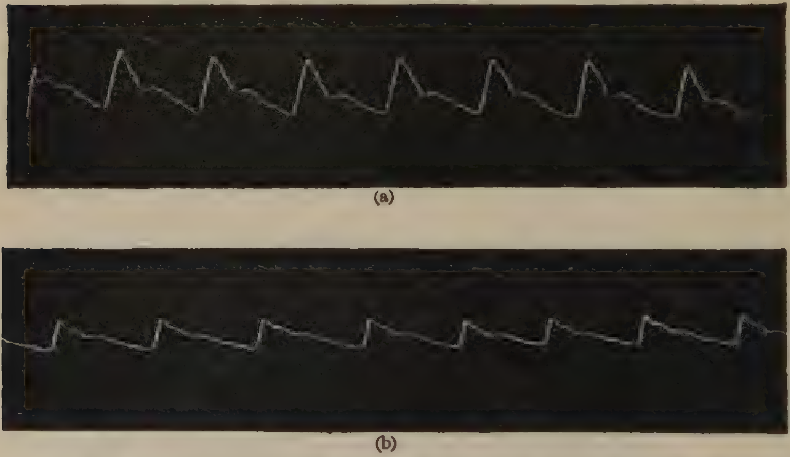

Fig. 125.—Sphygmographic Tracing Showing the Effects of the Cold Cardiac Compress in Raising the Blood Pressure. (a) Before Application (Tension Low). (b) After Application (Tension High). (From Kellogg's "Rational Hydrotherapy," Modern Medicine Publishing Co., Publishers.)

The *size* of the compress depends upon the area to be covered. The area should always be prescribed by the doctor. The compress may be applied to the anterior chest only or to both the anterior and posterior chest. In all cases the compress should be shaped at the neck and arms so as to snugly fit the part, and should extend from above the clavicles to below the umbilicus. The shoulders should be well covered and the compresses should extend well around at the sides. When the whole chest is covered it is often more convenient and disturbs the patient less to have separate compresses for the anterior and posterior chests. They should overlap on the shoulders and under the arms.

The *temperature* and *duration* of the application should always be ordered by the doctor as they must be regulated to suit the individual case. These factors will depend upon the patient's temperature and general condition, and upon the effect desired, which may be either a tonic or sedative effect. The purpose may be to relieve stupor, or excitability, delirium and sleeplessness. The temperature is usually about 60° F. and the compresses are as a rule changed once every hour as long as the patient's temperature continues high. Reaction usually occurs within one hour, that is, the skin and compress become warm. A nurse should previously ascertain from the doctor what steps are to be taken should reaction not occur within that time. The compress is usually removed, and the skin warmed (by gentle friction or by leaving the part covered with the flannel) before making a fresh application. A lower or higher temperature may be ordered. When a sedative effect is desired a higher temperature may be ordered and the compress may be left on for two hours or more until dry and warm.

Preparation of the Patient.—The bed must be protected as the compress is quite damp when applied. The patient is sometimes placed between blankets or the under sheets of the upper part of the bed only are protected and the upper bedding is turned down to below the waist. Again, as in all cold applications, it must be remembered that the patient's feet and body must be warm, and the area to which the application is to be made also be warm. Otherwise the desired effect will not be obtained.

To *make the application* the compress is wrung out of the water so that when applied it will be damp but not dripping. The flannel (when used) and wet compress should be applied together so as to avoid unnecessary disturbance of the patient. He should be turned very gently and quietly without exertion. The compress must be smooth, free from wrinkles or bulky folds, and must be in close contact with the skin of the whole area. Otherwise pockets of air will form and cause evaporation with chilling of the chest and the whole body. While the application fits snugly it must not be tight enough to embarrass the breathing. As a rule, no covering, except the thin piece of flannel, is allowed over the chest and compress. The effect desired is, by stimulation of the nerve endings in the skin and by reflex action, to bring an increased volume of blood to the skin vessels until the part becomes red and warm, and to allow the heat to gradually evaporate through the thin flannel. To add further covering would cause the heat to accumulate and give the effect of a hot poultice. However, the patient must not be allowed to become chilly. When the treatment is combined with "cold air treatment" the patient's arms may be wrapped in flannel or, in some cases, a thin blanket may be spread lightly over the upper part of the patient or may extend to the foot of the bed under the bedding. A hot-water bottle may be placed at the feet.

GENERAL COLD BATHS AND PACKS

General applications of cold to the body are made in the form of cold packs, sedative packs, cold tub baths, cold sponge and slush baths.

The effects of the applications will depend upon (1) the temperature of the bath; (2) its duration; (3) the form and method of application; (4) the condition of the patient.

Effects of a Brief, Intense, General Application.—The application will be followed by both a *primary, depressing* effect and, if successfully administered, a *secondary, stimulating tonic reaction.*

These will be similar to those which follow local cold applications but will be much more intense and will affect the whole body. The secondary effect is due to a reflex action. Both primary and secondary effects are protective, defensive reactions of the body.

1. *The Primary Depressing Action.*—The blood vessels of the skin and viscera contract simultaneously to prevent loss of heat from the body. The skin becomes pale and cool. Perspiration is checked, preventing loss of heat. The blood flows more slowly through the contracted vessels of the skin so it becomes pale and pinched. To make up for the chilling of the blood at the surface, the energy and tone of the voluntary muscles are increased so they contract and cause shivering with sometimes trembling, chattering of the teeth, and even painful and distressing symptoms. The body temperature may be raised. This explains why applications must be more prolonged to secure a drop in temperature, because they must be long enough to depress the heat-producing center. A very brief application will stimulate it.

The blood vessels of the head and viscera quickly dilate, owing to the sudden inrush of blood from the contracted skin vessels in contact with the cold. (For this reason cold applications should always be applied to the head before and during general applications.) In this way brief cold applications relieve congestion in the viscera by stimulating the rate of the flow of fresh blood to them and the removal of the products of waste and disease. The pulse is first quickened, then checked. The respirations are first checked (and may be gasping), then quickened, then become slower, fuller and deeper. The involuntary muscles of the stomach, intestines and bladder, etc., are stimulated. Those of the skin also contract, producing gooseflesh. The leucocytes of the blood are increased. The nervous system is depressed.

2. *The Secondary Stimulating Effect, or the Tonic Reaction* should follow immediately. The blood vessels of the skin dilate, those of the internal organs mechanically contract. The skin

becomes red, smooth, soft and warm. The patient has a general sense of comfort and well-being. Perspiration is increased. The pulse is slower with increased tension and force. Increased oxygen is absorbed in the lungs with increased elimination of carbon dioxid. The kidneys are stimulated and more waste products are eliminated. The liver is stimulated, also digestion and absorption in the alimentary canal. The mind is stimulated, the patient becomes brighter and more normal, the body temperature falls.

The beneficial effects following cold applications are chiefly due to the thermic reaction, that is, the reaction following the stimulation of thermic nerve endings in the skin, in the effort to replace the heat lost by exposure to the cold and to restore the body to normal. Not only the heat-producing organs, the muscles and glands, etc., are stimulated but the activities of every cell and tissue in the body. The appetite, digestion and absorption are improved, the blood flows more freely and all the vital functions are restored and quickened. This is the "tonic reaction" following cold applications.

Effect of Prolonged General Cold Applications.—A prolonged cold application results in a continued contraction of internal blood vessels unless the nerve endings in the skin become numb or lose their sensibility so that all reflex effect is lost. When this happens—indicated by the bluish, purplish skin—the congestion in the internal organs is increased and a great deal of harm may be done. This very undesirable effect may be avoided by removing the cold application every half hour and either rubbing the part or applying heat to restore the circulation in the skin.

As cold is a depressant, prolonged applications depress cellular activities—the longer the application, the longer the depression that follows. Sooner or later, however, the parts will return to normal and if not too depressed, the "tonic reaction" follows.

Thus we see that cold may be so applied as to secure its primary, sedative effects or its tonic, stimulating effects.

Friction and percussion are mechanical irritants or stimulants, either one or both of which are essential in promoting the tonic reaction following cold applications.

Friction may be employed—

1. Before cold applications, to stimulate the circulation in the skin, to promote the reaction and so avoid distressing symptoms.
2. During the application to stimulate the circulation and to prevent the nerve endings from becoming numbed, with resulting loss of reflex action.
3. Following the treatment, if necessary, to insure the reaction with reddening and warmth in the skin.

Conditions which Promote the Desired Reaction.—*Before the bath* means should be taken to stimulate the circulation in the skin and body generally. The skin should be warm and well reddened. This may be accomplished by exercise or friction of the skin, by a hot bath or hot drinks and by warm clothing. The air of the room should be warm. General health and vigor favor reaction.

During the bath the lower the temperature of the water the more prompt the reaction. Short sudden applications also favor reaction. Friction or some form of pressure or percussion (the douche or spray) are essential.

Following the bath reaction is promoted by heat in the form of hot, dry air, hot drinks and warm clothing. It is even possible to induce reaction in frozen parts by rubbing with snow or ice in a warm room. The lumberman in the north woods warms his feet by taking off his shoes and stockings and rubbing his bare feet with snow, immediately dressing them again. Friction with the hand or a rough towel and exercise favor reaction.

Conditions which Discourage Reaction.—Very young children and old people react badly. Old people in whom arteriosclerosis has begun react with difficulty and thus require special care. Very cold baths should be avoided. Exhaustion, either physical (from excessive exercise) or nervous (from loss of sleep) or extreme nervousness from any cause prevents reaction, owing to the weak condition of the nerve centers upon which prompt reaction depends. Profuse perspiration, a rheumatic tendency, an inactive skin, a cold skin or an extreme aversion to cold all discourage reaction.

THE COLD PACK

This consists in wrapping the body in a cold wet sheet and, except when used to reduce the body temperature, wrapping the patient carefully in dry blankets to prevent evaporation.

The **effects produced** will depend upon the length of the applications as they occur in successive stages, each stage depending upon the amount of heat allowed to accumulate. These stages occur in the following order: (1) The cooling stage which may be tonic or antipyretic; (2) the neutral or sedative period; (3) the heating or exciting stage, and (4) the sweating stage.

1. The *cooling stage* is characterized by contraction of the blood vessels, causing a sensation of chilliness, its duration varying with the individual. This sensation does not appear when the skin is hot or the temperature high. The contraction of vessels in the skin may cause cerebral congestion if cold is not applied to the head before beginning the pack. The body temperature is lowered. The patient may be nervous and excited for the first few minutes. The vasomotor and heat-regulating centers are stimulated to combat the cold. The "tonic reaction" follows with stimulation of all the vital processes of the body resulting in the improved function of every organ and stimulation of the heat-producing processes in the muscles, glands and digestive tract. The heat produced is expended to warm the cold sheet and evaporate its moisture. If the treatment is discon-

tinued at this point, that is, *after the reaction has begun*, its effect will be *tonic* and *alterative*.

This *treatment is used* as a tonic in all forms of wasting diseases and in chronic toxemia.

A cold pack may be given to reduce body temperature and relieve toxemia. This form of treatment is frequently used in fevers and is especially useful in typhoid fever as a substitute for the Brandt bath.

To produce the above effect, *when reaction sets in*, that is, as soon as the application is warm, it should be renewed in one of the following methods: (1) The wet sheet may be changed every five to ten minutes, as the case demands, with vigorous rubbing applied with each renewal and dry blankets wrapped around the patient; (2) The sheet may be sprinkled with cold water, the patient being turned from side to side so that the fresh application is made to the whole body. A sprinkler or whisk broom may be used, the sheet being kept continuously wet. Friction is applied throughout. The duration may be ten minutes. The temperature varies from 60 to 65° F., 70 to 80° F., or 85° F.

2. *The Neutral Stage or the Sedative Pack.*—This stage sets in as soon as sufficient heat is accumulated to raise the temperature of the pack to that of the body surface, that is about 98° F. If the pack is discontinued at this point or if further accumulation of heat is prevented, a sedative effect follows. The patient becomes quiet, calm and usually goes to sleep; the pulse and respirations are slowed; the kidneys are stimulated so that more urine is secreted.

This *treatment is used* as a therapeutic measure in chorea, in insomnia and the delirium of typhoid or pneumonia, etc.; in acute mania and in all forms of cerebral irritation.

3. *The Heating or Exciting Stage.*—When the heat is allowed to accumulate still further, reaching beyond the temperature of 98°, all the excitant effects of the hot bath (see page 408) appear. Cold applications to the head, therefore, must be constant and frequently renewed and the pulse must be watched carefully. If heat elimination, through perspiration, does not promptly set in, then all the depressing and exhausting effects of the prolonged hot bath occur.

4. *The Sweating and Exciting Stage.*—As the heat still further accumulates, the body temperature is elevated, the heat-eliminative processes are stimulated, perspiration becomes profuse and all the exciting and stimulating effects of the hot bath appear.

This *treatment may be used* in all cases where it is desired to increase the elimination of toxins and waste products.

Contraindications.—(1) In skin diseases; (2) in advanced cardiac or Bright's disease; (3) in febrile conditions.

Contraindications to the Cold Pack.—(1) In eruptions of the skin; (2) in asthma; (3) for those who, for any reason, cannot react without friction or other mechanical means because, in a cold pack, the body is left entirely to its own resources except in the method used to reduce body temperature and toxemia.

Method of Procedure.—*Preparation of the Patient.*—The patient is usually placed between blankets as in giving a hot pack. Before beginning the treatment the whole surface of the body, especially the feet, must be warm. Cold applications are applied to the head.

Method of Applying the Wet Sheet.—The sheet to be applied is usually wrung out of water at from 60° to 70° F. It must be wrung very dry. When applied, it must be wrapped smoothly, closely and snugly around the body so that no two surfaces of the body are in contact with each other. The sheet must be in such close contact with the whole body surface that no pockets of air remain. Such pockets of air would allow conduction and evaporation of heat, thus chilling small areas. This chilly sensation would gradually extend to the whole surface, delay the reaction, and cause great discomfort. When chilly sensations are prolonged, it is usually due to improper applications. Folds should be made in the sheet at the neck and shoulders so that it will fit snugly but not too tightly. If the feet do not react well they are left out of the wet sheet. This is frequently necessary. One or both arms may be left out if the patient does not react well. The blankets are wrapped smoothly and carefully around the body, fitted tightly and snugly at the neck in order to prevent any evaporation. They are pulled in such a way as to bring all the wrappings in close contact with the body surface. The blankets are so tucked in that the patient now looks like a mummy. A towel is arranged to protect the skin of the face and neck from the blankets. A large rubber may be wrapped around the patient and hot-water bottles placed at the feet or along the sides, if necessary, to further prevent evaporation of heat or to hasten the reaction.

Duration of the Pack.—The pack should end when the desired effect has been obtained. The *tonic effect* is usually attained in about twenty minutes, but is determined by the patient's sensations. A feeling of warmth and comfort indicates that reaction has set in and the desired effect is attained.

The *sedative effect* is usually attained in about one hour. The patient should be removed from the pack at this time, but, if asleep and previously very restless, the sedative effect may be prolonged, without disturbing the patient, by preventing the further accumulation of heat. The rubber and blankets should be loosened and the wrappings gradually removed. Great care must be taken to prevent local currents of air or chilling the patient in any way. On removal from the pack the patient should be dried with a warm towel, using as little friction as possible. The patient's gown should be warm.

For the *eliminative effect* the pack usually lasts about two hours, or as long as sweating continues without exhaustion. It must not be too prolonged. Symptoms of nervousness, headache, fainting or vertigo indicate overstimulation which may be injurious if allowed to continue. The after-treatment is the same as in the hot pack.

The Brandt Bath

This is the cold tub bath used in the treatment of typhoid fever. It consists in the complete immersion of the body in a bath at 95° to 85° F. or at 85° to 70° F. for from ten to twenty minutes. Some doctors prefer to use the bath at the higher temperatures given, believing that the results are better and that the shock, excitement, alarm and resistance of the patient to the extreme low temperature may do harm. The bath is accompanied by friction to the whole body surface throughout the treatment.

Effects of the Bath.—The nerve centers are stimulated and restored; vital resistance is increased; muscle tone, the activities of the kidneys, liver and skin are all increased. The amount of oxygen received and of carbon dioxid eliminated is nearly three times the normal amount, showing a marked increase of oxidation in the body. Blood-pressure is increased, the pulse is slowed, the heart is strengthened and stimulated and the number of blood corpuscles, especially the white cells, is increased.

The cold bath is used in typhoid fever for the following reasons:

1. To regulate and increase the movement of blood through the blood vessels, thereby preventing or relieving visceral congestion and resulting loss of function.
2. To stimulate the nerve centers and relieve them of the toxins which depress vital activities and cause headache, delirium, insomnia, stupor or coma, etc.
3. To relieve congestion and increase the activity of the liver so that it can destroy the toxins brought to it from the intestines and so protect the whole system.
4. To improve the circulation of the kidneys, thereby preventing nephritis and increasing the elimination of toxins. The volume of urine may be greatly increased.
5. To improve the circulation, the nutrition and the function of the skin and so increase the elimination of heat and waste products and prevent bedsores.
6. To stimulate respirations.
7. To increase oxidation, including that of toxins so aiding in their destruction and elimination.
8. To increase the flow of digestive juices, the absorption and assimilation of food, thereby improving the appetite, and the nutrition and function of every body cell.
9. To improve the quality of the blood and increase the number of red and white blood cells. In typhoid the white cell count is low.
10. To build up vital resistance and cause the destruction and elimination of toxins from bacteria and tissues.

11. To tone up the muscles of the heart and blood vessels and prevent failure due to toxins.
12. To lower the body temperature and to make the patient more comfortable.
13. To prevent complications—bedsores, intestinal hemorrhage, perforation, pneumonia or nephritis.

The typhoid tub bath is usually given every three or four hours when the temperature is 102° or 103°, not because the lowering of the temperature is the primary object, but because the temperature runs parallel with and is a definite, easily determined indicator of the increased toxicity of the body. The patient dies from the effects of toxins in the body, and not from the increased temperature. In fact, the increased temperature is now believed to be a defensive reaction on the part of the body—an effort to destroy and to repel the germs which cannot live in a higher temperature.

However, this reaction too, like an inflammatory reaction, though purposeful and beneficial, may go beyond the point of safety and defeat its own purpose so that it, too, must be regulated. For it has been found that an internal temperature (always two or three degrees higher than that registered in the axilla) of 107.6° to 109.4° will destroy the white blood cells, and further lower the resistance by causing a rapid wasting of muscular and other tissues of the body.

The typhoid tub bath, therefore, aims to destroy and eliminate the toxins and prevent or relieve their poisonous effects on the body.

It is **contraindicated** in

1. Infancy, old age or inability to react.
2. Shivering, sweating, a subnormal temperature or collapse.
3. Threatened intestinal hemorrhage or perforation.
4. The presence of blood in the urine.
5. In skin diseases, pneumonia, nephritis, and other acute inflammatory conditions.

Method of Procedure.—Strict typhoid precautions must be observed throughout the treatment.

Preparation of the Patient.—The patient is covered with a sheet. The upper bedclothes are removed or fanned to the foot of the bed. The patient's gown is removed and his loins are draped. The canvas usually used for lifting and supporting the patient in the tub is then put carefully under him. The poles, used for lifting, are then inserted in the canvas. He should be disturbed as little as possible and prevented from exerting himself in any way. Non-absorbent cotton may be placed in the ears to avoid the accidental entrance of cold water, as this may cause earache, headache, dizziness and nausea. Cold applications are applied to the head and face, the temperature of the application being much lower than that of the bath.

Preparation of the Bath and Method of Giving.—Before the patient is prepared the necessary articles and utensils are brought to the bedside. The tub is filled about two-thirds with water at the required temperature, and is brought to the bedside. Two people lift the patient on the stretcher very carefully, but as quickly as possible, from the bed into the water. The sheet covering the patient is not removed until after he is in the bath. No exposure should be allowed. The patient must be immersed to the neck, care being taken not to leave the shoulders uncovered as this would allow evaporation and cause chilling and possibly pneumonia. The head is supported with a rubber pillow or air-ring. The sheet is then removed. The patient must be in a comfortable position and supported so as to avoid all strain or exertion.

During the bath friction is applied throughout the whole treatment. Friction is not applied to the abdomen. Hair on the chest, if long and plentiful, should be cut short, because the rubbing and bathing make the hair follicles red, swollen and painful. The cold applications on the head should be changed frequently and their temperature kept constantly lower than that of the bath.

The patient will shiver and complain of chilliness at first. If he continues to shiver, if his teeth chatter and his skin becomes cyanotic, stop the treatment. Remove him at once from the bath, cover him with a sheet and blanket and rub until reaction sets in. A patient is not, as a rule, removed from the bath because he complains of chilliness unless his teeth chatter. Treatments are not as a rule discontinued because of chilliness, but the doctor may order whisky, or may raise the temperature or shorten the duration of the bath, or friction may be increased. The patient's pulse should be watched carefully. He should be watched closely for symptoms of chill or cyanosis, and for symptoms of hemorrhage or perforation on account of moving the patient.

The duration of the bath is usually ten minutes unless otherwise ordered.

While the patient is in the bath, his bed may be completely remade or the linen may be tightened and freshened, then covered with a large rubber.

When the bath is completed, the patient is again covered with the sheet and the loin draping is removed. Two people, as before, carefully lift the stretcher and the patient and hold it over the tub to allow the water to drain off before placing it on the bed. The cold applications are then removed from the head and the patient is dried with the sheet. As the patient is turned from side to side, the wet rubber and canvas may be removed and the back dried and rubbed with alcohol and talcum. The patient's gown, the pillows and bedclothes are replaced and the damp sheet removed.

The patient's temperature is usually taken one hour after the bath. Some doctors prefer, however, that the patient, if sleeping, should not be disturbed for this purpose as a natural sleep is one of the effects for which the bath is given. A nurse should find out from the doctor what his wishes are in this respect. Sleep must not be confused with a toxic condition of stupor. In this condition, taking the temperature will not disturb the patient.

When *charting* the treatment, its general effect and the way in which the patient reacted should be noted.

THE COLD WET HAND RUB

This treatment consists in rubbing the whole surface of the body with the cold wet hand.

The **effects** are those resulting from cold applications combined with the mechanical effects of friction. As the application is made and reaction produced in different parts of the body in succession, no marked retrostasis with internal congestion occurs as in the tub bath, while its tonic and stimulating effects are gradually produced.

The **treatment is used** in febrile conditions where the cold tub bath is too vigorous a treatment.

The *temperature* varies from 40° to 75° or from 65° to 90° F. according to the age of the patient and his ability to react.

The *duration* is usually about ten minutes, the application being made and reaction secured in each part as quickly as possible. When the duration is ten minutes, three minutes should be devoted to the anterior surface and seven minutes to the posterior for the following reasons: (Hare) (1) The great muscles and the thick skin of the back retain the heat; (2) the posterior parts, the skin and viscera are more apt to be congested and need the stimulating effect of the cold application and rubbing, in order to prevent the skin from breaking down and in order to stimulate the functions of both the skin and internal organs such as the kidneys and lungs, etc.

Method of Procedure.—*Preparation of the Patient.*—Before beginning the treatment everything likely to be required should be brought to the bedside. The patient is covered with a large sheet. The clothes are fanned to the foot of the bed, the pillows and gown are removed; the loins are draped and a large warmed rubber which may be covered with a sheet is placed under the patient to protect the bed. The body must be warm before the treatment is given in order to secure a prompt reaction. Brief friction should first be applied to stimulate the skin, prevent chilling, and to hasten the reaction. A hot-water bottle may be placed at the feet to encourage the reaction and for comfort. Cold applications are applied to the head.

During the treatment, the upper sheet may be removed, or it may remain and only the parts under treatment be exposed in succession, then covered as reaction sets in. The treatment may be given without any exposure. Reaction must be produced by rubbing. If possible, two nurses should give the treatment, one applying water with her hands and rubbing the face, anterior surface of the trunk and upper extremity, while the second nurse treats the lower extremities. This should last three minutes. The patient is then turned and the posterior surfaces treated, beginning with the neck, shoulders, chest, etc., with special attention to the spine. This lasts seven minutes.

During the treatment it is important to watch the patient's color and pulse. Sometimes one-half ounce of whisky is given if the patient's color and pulse are poor. It is not used as extensively as formerly, as it is now believed to depress nerve centers and weaken the action of the heart muscles. Many believe that it does not stimulate and therefore does not aid in securing a reaction.

When the treatment is completed, the patient is covered with the sheet and dried gently, using very little friction. The rubber, etc., is removed, a warm gown is put on, and the pillows and bedding, etc., are arranged to the comfort of the patient.

In *charting,* the patient's temperature and reaction to the treatment are charted as after a cold tub-bath.

The Cold Sponge Bath

This treatment consists in the application of cold water to the body surface by means of a wet sponge, combined with friction or rubbing with the hands.

The *effects* of the bath are the same as in the wet hand rub, but as more water is usually used, more heat is lost, and the reaction is more intense.

Its *uses,* the *underlying principles,* and *method of procedure,* are also the same. As it is a more vigorous treatment special care should be taken to see that the surface is warm before beginning, that the feet are warm throughout, and that a marked reaction is produced, the pulse and color of the patient being carefully watched.

The Spray or Slush Bath

When it is desirable to use still more water, extra protection for the bed is provided. This is arranged so as to provide a trough, and the head of the bed is elevated so that the water will drain into a receptacle on the floor at the foot of the bed. The water is either sprayed or poured from a pitcher over the body, thus adding the mechanical stimulus of slight percussion.

CHAPTER XXV

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY DOUCHES AND MEDICINAL BATHS

HOT AND COLD DOUCHES

A douche consists of a single or multiple column of water directed against some portion of the body.

Physiological Effects.—By the application of the douche all the thermal effects due to applications of either heat or cold are hastened and intensified by the mechanical effects of the pressure or force and volume of water used.

The **effects** depend upon the following factors:

1. The *temperature* of the water used. This varies from 45° to 125° F.
2. The *pressure,* which varies from ten to sixty pounds.
3. The *duration* varies from three or four seconds to four or five minutes, depending upon the temperature, pressure and other factors in the application.

The neutral or sedative douche at a temperature of 92° F. and with very low pressure is sometimes prolonged to fifteen minutes.

4. The form of the stream is determined by the outlet. The horizontal, vertical, fan, or broken jets may be used. The form may be the shower spray or needle bath applied to the surface of the body and irrigations to various cavities of the body such as the eye, ear, nose, throat, stomach, rectum, colon, bladder, vagina or uterus.
5. The area covered, which may be local or general.
6. The part of the body to receive the application, if local, as in the dorsal, lumbar and spinal douches.

Purposes of the douche:

The douche, either as a local or general application, may be used to produce tonic, stimulating, sedative or analgesic effects as desired.

It is *contraindicated* in acute inflammation, and in very nervous, excitable patients where it is necessary to suppress reaction due to the application.

As the effects of the douche depend entirely upon the scientific regulation of the above-mentioned factors and as these factors can only be accurately administered by a very highly trained person and by specially constructed apparatus, no attempt will be made here to discuss the various applications. A special room is also necessary. The use of the apparatus and the method of procedure can only be taught by practical demonstrations. Except in special hospitals, nurses are not, as a rule, trained or required to give special treatments. A spinal douche, however, may be given fairly successfully either in the hospital or in a private home, and so may be prescribed by the doctor.

Spinal Douche

In the spinal douche a stream of water is moved rapidly up and down over an area covering the whole surface of the spine and extending three or four inches on either side of it.

The **effects** of the treatment vary according to the temperature, pressure and duration of the application. When special apparatus is not available it is difficult to obtain the exact temperature desired and impossible to secure the desired pressure. When desirable, friction may be used as a mechanical substitute for pressure.

A *tonic effect* may be obtained by a cold spinal douche. The temperature may vary from 45° to 78° or 80° F. The *duration* may be for three or four seconds.

A *sedative effect* may be obtained by a *tepid* (80° to 92° F.) or a neutral (92° to 97° F.) douche. The *duration* may be three or four minutes.

An *analgesic* effect may be obtained by a *hot* douche. The temperature varies from 104° to 125° F. The *duration* may be from one-half to four or five minutes.

The *temperature* should begin at 100° F. and gradually increase to the maximum. As a hot douche is usually given to relieve pain, a low pressure is always used and the stream must be rapidly moved from point to point to prevent burning. The high temperature mentioned may be used because the skin of the back is not as sensitive as in other parts of the body.

The Scotch Douche.—The spinal douche may be given in the form of a Scotch douche in which a single application of hot water is followed immediately by a single application of cold water. The hot douche lasts from one to four minutes, and the cold douche from three to thirty seconds.

The *purpose* of the hot douche is to warm the part in order to intensify the effect of the cold, and to secure a better reaction. It also trains the patient to react to the cold douche and makes it feel grateful. The cold douche must follow the hot instantly as any lapse allows the wet surface to cool off rapidly by evaporation. The purpose of the hot application would then be lost.

The Alternate Douche.—When the spinal douche is given in this form, hot and cold applications are repeatedly applied in alternation. The duration of each application is usually about fifteen seconds.

Method of Procedure.—When the treatment is given to the patient in bed, the preparation of the patient and bed is the same as in a spray or slush bath. The patient should lie prone or on his side. Only the back should be exposed. A hot-water bottle may be placed at the feet, if necessary, as they must be warm. The body should also be warm. Friction may be applied before, during and after the treatment, if necessary, to obtain the reaction. Cold applications may be applied to the head.

When the patient is able to get out of bed, he is covered with a large sheet or bath blanket and is allowed to sit on a board placed across the foot of a bath tub. He may sit on a box or stool placed in the tub. This is especially advisable to avoid an accident and injury when the treatment is given for chorea in which the jerky, uncertain and uncontrollable movements of the patient make it impossible for him to sit without support. His back should be toward the faucets. The sheet or blanket is then draped so as to completely cover the body, leaving the back only exposed. The feet should rest on a stool or should be placed in a foot-tub of water at from 100° to 110° F. In a very hot douche this is necessary to prevent burning and in a cold douche to secure reaction.

To give the douche a spray is attached to the faucet and the stream is moved rapidly up and down over the prescribed area. When a hot douche is used great care must be taken to avoid burning the patient. A nurse should test the temperature of the water by directing it against her arm.

When the treatment is completed the care of the patient is the same as after a sponge or spray bath.

The Affusion

The affusion, like the douche, is a stream of water directed against the body. Unlike the douche, it has little mechanical effect and is applied to a larger area of the body. It may be a local or general application, the water being poured over the part from a pitcher or a pail.

The Effect of the Affusion.—The usual thermal and circulatory reactions follow according to the temperature used.

The *treatment is used* as a therapeutic measure in syncope, collapse, or shock, in asphyxia, in fevers and in hypostatic congestion. In private practice it is sometimes used instead of the douche.

It is *contraindicated* in typhoid fever with complications, in hemorrhagic cases, and in patients with a decompensating heart.

Miscellaneous Baths

These are baths in which various substances are added to the water, which, according to the ingredients used, either increase its irritating and stimulating effect, or lessen and soothe irritation.

THE EFFERVESCENT OR NAUHEIM BATH

"This consists of a full bath the water of which contains chlorid of calcium, carbonate of soda, and carbonic acid gas." It is an artificially prepared bath used as a substitute for the natural mineral water of the famous resort of Nauheim, Germany.

The effects are the same and depend upon the proportion of chemical substances used.

Composition of the Bath.—The following ingredients are put up in powder form so that one, two or three powders may be used according to the intensity of the effect desired.

Sodium carbonate	1½	pounds
" bicarbonate	½	"
Calcium chlorid	3	"
Sodium chlorid	2	"
" bisulphate	1	"

Effects of the Bath.—These chemical irritants added to the neutral bath produce a powerful circulatory reaction—that is, dilatation of the cutaneous blood vessels, with contraction of the adjoining and associated visceral vessels—without provoking a thermic reaction. The disadvantages of using extremes of temperature, in certain cases, may thus be avoided.

The *bath is used* in cardiac and renal diseases where extremes of temperature are undesirable or dangerous.

Method of Procedure.—The tub should be lined with rubber to prevent injury to it due to the chemical ingredients.

The Nauheim baths are very exhausting and therefore only to be used with the greatest caution. If dyspnea is present the patient must not enter the bath; the breathing must be quiet and tranquil. The chest should be wet before entering, and the limbs well rubbed during the bath. No exertion must be allowed either during or after the bath.

The baths are carefully graded to suit the patient as regards the strength of the ingredients used, the temperature and the duration of the bath. They should begin with the mildest ingredients, at 95° F., should last only two or three minutes, and should be given only every other day. Even the strongest must not take more than three baths in succession without a day's interval.

The patient must not be allowed to become chilled before, during or after the bath. After the bath the patient should be wrapped in a hot sheet, and given friction until dry. He should then be allowed to rest for an hour or two.

SALINE BATHS

These are artificially prepared sea-water baths.

Composition of the Bath.—Eight pounds of sea-salt to thirty gallons of water, or by using five to eight pounds of ordinary salt, practically the same effects may be produced. For partial baths use four ounces to one quart.

The *temperature of the bath* is usually 70° F. The *duration* is usually ten minutes with friction during and after the bath.

Effects of the Bath.—Sea-water feels much warmer than fresh water because the salts present irritate or stimulate the nerves in the skin and so hasten the reaction, or the increased flow of blood in the skin and the feeling of warmth and comfort. This makes it possible to give the saline bath two or three degrees lower than that of the fresh water bath usually tolerated by the patient, so that both the desired circulatory reaction and the tonic effects of the thermic reaction are produced. The usual precautions are taken to avoid chilling or exhaustion. After the bath the patient should be wrapped in a warm sheet and brisk friction applied.

THE MUSTARD BATH

In the mustard bath, mustard is added as a chemical irritant to hasten the reaction and stimulate the circulation in the cutaneous blood vessels. It is used as a stimulating bath particularly for infants and young children to restore vitality. It is frequently used in convulsions in infants to relax the muscles and relieve the spasm, due to its stimulating effect on the nervous system.

Composition of the Bath.—One tablespoonful of mustard is used to one gallon of water. Half this strength is used for a mustard bath for infants. The mustard must be mixed in the usual way into a paste with tepid water, then further dissolved and thoroughly stirred into the bath water.

The *temperature* must be suited to the patient's condition, but may be lower than when water alone is used. It is usually 80° to 90° F. if the full effect of the mustard is desired. When the temperature is from 105° to 110° F., the mustard helps at first by hastening the desired reaction, but the effect of the mustard is soon destroyed by the heat. (See Chapter XVI.)

ALKALINE BATHS

These are artificially prepared baths used as substitutes for natural mineral springs which owe their soothing effects to the alkaline ingredients present.

Composition of the Bath.—Four to twelve ounces of carbonate of soda to thirty gallons of water; or one-half ounce of carbonate of soda to the quart for local applications; or eight ounces of bicarbonate of soda to one gallon of water are used.

Alkaline baths are most commonly used in various skin diseases and in jaundice and urticaria to relieve itching.

EMOLLIENT BATHS

These consist of the usual neutral tub bath to which some emollient substance has been added.

The **composition of the bath** may be four to six pounds of bran to thirty gallons of water. The bran is boiled in a bag for twenty minutes, the water is then drained off and added to the bath. One pound of corn starch to thirty gallons of water may also be used. The starch is first mixed into a smooth paste with cold water. Hot water is then slowly added (stirring constantly), until the mixture is thin enough to pour. It is then added and mixed thoroughly with the bath.

The *temperature* of the bath is usually from 93° to 96° F.

The bath is used to relieve skin irritations of various forms.

THE SULPHUR BATH

Sulphur is an insecticide, and is very injurious to lower forms of vegetable life. It is used extensively in the form of an ointment and occasionally in the form of a bath in acne and in various skin diseases in which parasitic organisms are present such as scabies.

To prepare the bath, dissolve from one-half to two ounces of potassa sulphurata (sulphurated potash) in a small amount of hot water and add the solution to the bath-water (15 gallons). The *temperature* of the bath usually varies from 90° to 96° F. The *duration* varies from ten to thirty minutes.

The bath tub should be protected as sulphur is injurious to metals. It must be thoroughly disinfected after use when the bath is given to relieve infectious skin diseases.

Method of giving the Bath.—When the alkaline, emollient, or sulphur baths are given to relieve irritations of the skin, the patient should be allowed to lie quietly in the bath for the duration ordered. No friction should be applied during or after the bath. When the bath is completed the patient should be wrapped in a warm sheet and dried by gently patting over the sheet.

THE ALCOHOL SPONGE BATH

The alcohol sponge bath is given as a cooling, refreshing measure when you wish to disturb the patient as little as possible by turning or moving.

Alcohol evaporates and cools the surface quickly so that only a small amount of alcohol is needed and the patient is less tired out than in the more prolonged water sponge bath.

The **composition of the bath** is usually one part of alcohol to three parts of water at any temperature desired.

The *bath is used* as a cooling measure to reduce fever, and to relieve the night sweats of phthisis.

Method of Procedure.—The bath is given like the cold sponge bath already described with the exception that as only a small amount of alcohol is used and as the chief purpose may be to avoid turning or moving the patient, no rubbers are used to protect the bed. Bath towels are placed at either side of the patient and under the legs. The sponge should be only slightly wet. The back should be rubbed with the hand moistened with alcohol instead of with the sponge and, if advisable, without turning the patient. Sometimes the alcohol sponge is preceded by a warm bath in order to bring the blood to the surface and increase the evaporation of heat when the alcohol is used. If given with care the bed should not become dampened.

CHAPTER XXVI

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES BY LAVAGE, GAVAGE, AND TEST MEALS

These treatments are commonly used in diseases of the alimentary tract for a therapeutic effect or as an aid to diagnosis.

Gastric Lavage

A lavage is a method of washing out the stomach. Lavage is a French word derived from the Latin *lavare,* "to wash," and is used to express the washing out of a hollow organ.

Conditions in which a Lavage is most Commonly Used:

1. In acute gastric catarrh due to irritant, toxic, decomposing substances, corrosive poisons, or alcohol, etc. In this condition the contents of the stomach show an increased secretion of mucus and a lessened secretion of hydrochloric acid, pepsin and rennin.
2. In chronic gastritis in which the stomach may be enlarged or atrophied with lessened motor power and secretions. The return may show quantities of thick, brown, tenacious mucus which may form a thick scum on the water.
3. In gastric carcinoma in which there is usually a lessened amount or a total absence of hydrochloric acid. This condition prevents digestion, causes stagnation, prevents the opening of the pyloric valve, permits the growth of bacteria and fermentation with the production of gases, acids and dilatation of the stomach. There may be the appearance of blood or of "coffee ground" vomitus. This is due to the presence of partly digested blood, that is, blood in which the hemoglobin has been broken up by the gastric juice and the hematin set free. Hematin is a brown pigment which gives to the contents its "coffee ground" appearance.
4. In persistent vomiting.
5. In some cases of intestinal obstruction with fecal vomiting due to the retroperistalsis in the intestine and regurgitation of its irritating contents through the pyloric valve into the stomach.
6. In some cases of gastric ulcer but here lavage is usually contraindicated.
7. Sometimes following operations, before the patient is con-

scious, to thoroughly wash out the stomach and free it from ether, and bile, etc., so as to prevent later discomfort, nausea and vomiting.

8. In dilatation of the stomach which may be

(a) Acute—following a general anesthesia or injuries to the head and spine, etc.

(b) Chronic—due to pyloric stenosis or obstruction from any cause. It may be due to strictures, or carcinoma in the stomach or external to the stomach but causing pressure on the pylorus; or it may be due to motor insufficiency or loss of muscular tone which may be the result of chronic gastritis, general debility or anemia, etc.

(c) The result of distention when the stomach is constantly filled to excess as in beer drinkers or in diabetic patients whose tissues are unable to assimilate the food (sugar) and who are therefore unsatisfied and ravenously hungry. The normal limit or capacity of the stomach is from 1500 c.c. to 1700 c.c., but there are cases in which the stomach has been found to contain 120 ounces. The dilatation is chiefly in the cardiac portion. In any case where fermentation is marked the peristaltic wave is observable over the organ and the splashing of the contents may be felt on palpation or heard on auscultation. Marsh gas is said to be one of the gases formed as a result of fermentation and, during eructations of this gas, it is stated that it may be ignited at the mouth.

A lavage may be given for the following reasons:

1. To cleanse the stomach of undigested food, fermenting material, gases, toxic and poisonous substances or mucus. Mucus in the return from the diseased stomach—thick brownish and tenacious—must be distinguished from mucus from the throat which is thin, abundant and transparent.

The stomach is usually washed out before a meal because even a small amount of the sour fermenting substance left in the stomach between meals will contain bacteria and will be sufficient to reinfect each meal as it enters the stomach, resulting in fermentation with the formation of gases and acids and a great deal of distress and pain after meals.

2. To cleanse, give comfort and prolong life in carcinoma.

3. To stimulate peristalsis and the secretions in the stomach. The repeated distention and emptying of this muscular organ is said to act as local gymnastics stimulating and strengthening it. In nervous pains it may act as a warm sedative douche.

4. To check hemorrhage. A very hot or very cold solution is used with great caution.

It is **contraindicated** (or should be given with great caution) in:—

1. Ulceration with hemorrhage or following a recent and very severe hemorrhage from the stomach due to ulcer or carcinoma, etc.

2. Uncompensated heart disease.
3. Aneurysm of the thoracic aorta.
4. Advanced pulmonary tuberculosis.
5. Apoplexy.
6. Cirrhosis of the liver causing obstruction of the portal circulation with varicose gastric veins which predispose to hemorrhage. The blood supply to the walls of the stomach is very free and the blood vessels freely anastomose so that a hemorrhage from a gastric ulcer or other cause may be very severe.
7. Advanced arteriosclerosis.
8. The habitual use is injurious and should be avoided.

Method of Procedure.—In giving a lavage the following *articles* will be necessary: a dressing rubber and drawsheet to protect the patient and the bed; a kidney basin in case the patient vomits; gauze handkerchiefs to wipe away the mucus, etc., and to cleanse the tube; a paper bag for the soiled handkerchiefs; a large pitcher containing the solution; a small pitcher for pouring; a pail for the return and a basin containing the stomach tube in cold water or ice. (A rubber catheter is used in giving a lavage to an infant.) This hardens the rubber, makes its passage easier and makes the taste and feeling less disagreeable to the patient. No lubricant is necessary or desirable as any lubricant is disagreeable to the taste and increases the tendency to nausea and the normal mucus in the throat is usually a sufficient lubricant. This mucus is also increased when the tube is being passed. The *tube* used should be smooth and flexible, about 4.5 to 5 feet long, of medium size, but large enough to allow for the return of semisolids without clogging. Otherwise only the fluid will be carried off, leaving a more irritating fermenting mass behind. The end of the tube should be closed and rounded. The holes should be large and at the side, not at the end, in order to avoid the direct force of the application against an irritated surface such as an ulcer and to prevent direct suction in the return should the hole be in contact with an ulcerated area, as this would predispose to a hemorrhage. No pump should be attached to the ordinary stomach tube, as its use, by suction, may injure the coats of the stomach. In exceptional cases a pump is used to create a vacuum and produce suction to aid in the return, but it should always be used with great caution.

The *solution* may be plain water or water containing salt or bicarbonate of soda (ʒ i to a quart) which softens and dissolves the mucus. In cases of poisoning a solution of potassium permanganate, tannic acid, or silver nitrate may be used.

The *temperature* may be from 100° to 106° when used for cleansing. It may be tested by pouring the solution over the back of the hand as differences of one or two degrees have little effect.

The *quantity* may be from two to six quarts, depending upon the condition. When given for cleansing the treatment is continued until the return is clear.

The physical and mental condition of the patient.—Before beginning the treatment it is important to know the patient's mental condition and attitude, his physical condition, the diagnosis of the disease, the purpose for which the treatment is given, and whether it is given for the first time or not. If the patient has had previous treatments there will be no difficulty, but if it is an entirely new experience there will be difficulty in passing the tube and considerable distress and discomfort to the patient. Reassure the patient about the total absence of danger, the certain great relief which will follow, and the fact that the discomfort, which is greatly lessened by lack of resistance, is only temporary. Explain that at first there may be gagging and vomiting, and a choking sensation, but that there will be no difficulty in breathing when the tube is once inserted properly. The insertion of the tube will be greatly aided if the patient swallows continually. The patient will probably struggle and invariably becomes cyanosed, but this is due to the choking and struggling and not to the tube having entered the larynx, which is possible under certain conditions, but not at all probable.

If the patient is very nervous or irrational, assistance will be necessary and a mouth gag should be used to prevent the patient from biting the tube.

When given for dilatation, with accumulation of pent-up fluid and gases, etc., special care should be taken to protect the bed, etc., and to quickly invert the funnel and keep it directed downward when passing the tube, in order to allow the escape of the fluid, etc., into the pail. When the stomach is full the cardiac sphincter is closed, and the accumulation is largely in this cardiac portion. The gases being lighter will be at the top, so when the stomach is relieved, the gases and fluid are released and expelled with considerable force and the result may be disastrous to the appearance of the nurse and the surroundings.

Also, when the patient has been vomiting, it is wise to invert the funnel, after passage of the tube, to siphon back the contents before introducing the solution. In this way considerable fluid is frequently obtained, the patient is made more comfortable and is relaxed, so that the treatment is given more easily and with better results. In carcinoma and gastric ulcer the nurse must be on the lookout for pain and for blood in the return. *Discontinue the treatment if there is blood* in the return. Again, in all cases but particularly when the patient is known to be weak, watch the patient for pallor, a flagging pulse and other signs of exhaustion.

The *time* and *frequency* of the treatments vary, but they should not be given within from five to six hours after a meal. While food normally begins to leave the stomach in one-half hour, it is not normally completely emptied in less than from four to six hours. The purpose of the treatment is to remove contents which are irritating, which the stomach cannot expel in the normal time, which interfere with its function and if allowed to remain will ferment and sour the next meal eaten. A lavage is sometimes necessary two or three times a week or may be necessary every day. It is best given before breakfast so that the stomach will be in the best condition to digest the food given.

The *position* of the patient should be comfortable and free from strain. The treatment may be given with the patient lying down, but is best given with the patient sitting up. The rubber and sheet are arranged so as to protect the patient and the bed.

Before *passing the tube,* remove any false teeth or a plate which the patient may have. Remove all air from the tube by squeezing it between the fingers. The tube must be empty when inserted so that in this treatment air is not expelled by passing water through the tube, on account of the danger and possibility of water trickling into the trachea. The introduction of air into the stomach will cause pain and flatulence and will also interfere with siphonage. It is not necessary to lubricate the tube (except when it is soft and recoils on itself or when the tissues are inflamed or ulcerated), as the mucus in the throat is sufficient and any lubricant tends to cause nausea. Occasionally it is necessary to paint sensitive parts with cocain but the patient soon becomes accustomed to the treatment.

Ask the patient to hold the head *slightly forward.* Holding the head back makes the act of swallowing, and therefore the passage of the tube, difficult. Pass the tube along the curve of the hard and soft palate into the pharynx and esophagus but avoid touching the back of the pharynx, if possible, as this causes gagging. Normally the upper end of the esophagus is closed; this prevents the entrance of air into the stomach. Ask the patient to take deep breaths, to breathe slowly with the mouth open, to say a-a, then to swallow continually if possible. This flattens the tongue and opens the esophagus and starts the contractions of its muscles which carry the tube downward. When the tube enters the esophagus there may be a muscular spasm. *Never try to force a passage,* as this only increases the spasm. Stop, ask the patient to breathe more slowly and deeply, then if the patient swallows, the spasm relaxes. There are two other constricted portions of the esophagus which may make the passage difficult,—one a little below the opening, the other where the muscles of the diaphragm form a sort of sphincter around it, as it passes through the diaphragm. If the patient simply keeps on swallowing, the tube will pass without difficulty.

The *length of the tube to insert* varies with the patient. The esophagus begins at the sixth cervical vertebra and its lower end passes through the diaphragm opposite the tenth thoracic vertebra, to enter the stomach opposite the eleventh thoracic. In the adult the average length of the esophagus is about ten inches and the distance from the teeth to its opening is about six inches, making the distance from the teeth to the entrance of the stomach 15½ to 16 inches. The average length of the tube inserted is about 18 inches.

The stomach tube is quite large so that normally there is little danger of passing it through the small and carefully guarded opening into the sensitive larynx. However, where the muscles are relaxed or paralyzed, or when the nerve endings are stunned and fail to give warning or when the patient is unconscious and the brain asleep so that the warning comes in vain, it is possible then for the tube to enter the larynx. Therefore note the color and breathing of the patient; if the patient becomes cyanotic, if a hissing sound is heard instead of a gurgling sound, or if air can be felt when the funnel is held against the cheek, do not pour the water into the funnel as the tube is probably in the larynx and the water would enter the lungs and drown the patient. Remove the tube. If the patient is breathing naturally and does not become cyanosed, it is safe to proceed.

When the stomach tube is in place, quickly fill the funnel; allow the water to run through, but before the funnel or tube is entirely empty refill it to prevent air from being drawn in. Never allow the tube to become empty, as this causes a very painful, dragging sensation in the stomach. Allow the fluid to run in slowly, never with force. When two or three funnelfuls have been introduced, and before all the water has run through the tube, pinch the tube and invert the funnel over the pail and allow the fluid to siphon back. If you allow all the fluid to enter the stomach, leaving the tube empty, it will be difficult or impossible to obtain any siphonage. *Never* introduce more than one pint without siphonage, for in dilatation of the stomach large quantities may be retained causing increased discomfort and a resulting paralysis of the walls of the stomach. Continue the treatment until the return is clear unless there is pain or blood in the return or the patient shows signs of exhaustion; then discontinue and report the condition to the doctor.

When the treatment is given for the first time, the patient may vomit, the vomitus returning around the tube. If vomiting continues, it is usually advisable to remove the tube and to reinsert it after vomiting has ceased. Use gauze to cleanse the secretions and vomitus from around the mouth. Sometimes the return from the lavage comes back around instead of through the tube. This may be because the tube is clogged with a semi-solid substance or filled with air. When clogged, pouring in another funnel of water may dislodge the substance, or it may be necessary to remove the tube and cleanse it. To expel air, pinch the tube and squeeze through the fingers in order to create a vacuum and obtain suction. It may also be because the tube is not in the stomach; the tendency of the stomach is to expel it. When there is difficulty in obtaining the return or the flow stops it may help to move the tube up or down slightly or to pour in more fluid until the patient complains of a sense of fullness. When a nurse is giving the treatment, however, it is safest to pour in only one extra funnelful.

When the treatment is completed, pinch the tube tightly in front of the teeth (using gauze or the drawsheet) and withdraw it quickly to prevent food or fluid entering the larynx. Return the tube to the basin. Cleanse the patient's mouth and face; remove the draping and make the patient comfortable. Remove and cleanse the utensils. A mouth-wash, particularly if the patient has been vomiting, will be very refreshing.

In charting, chart the amount and character of the vomitus (if any), the amount of flatulence, the quantity and quality of mucus, the color and any abnormality in the return and the amount of water used before the return became clear.

The Care of the Stomach Tube.—When used for one patient only, the stomach tube need not be boiled after use as frequent boiling softens and renders it useless. It should be cleansed inside and out with cold water then with warm water and soap. If hung up to drain, spread the tube over a towel and do not allow it to bend at a sharp angle as this will cause the rubber to crack when dry.

When the same tube is used for other patients it should be boiled for from one to three minutes both for cleanliness and for esthetic reasons.

A GAVAGE

Gavage is a French word derived from *gaver*, which means to gorge fowls, and is therefore used to indicate forced feeding through a tube. It is a method of introducing liquid food or medicine into the stomach through a stomach tube for patients who cannot, or will not, swallow food. A tube of small caliber such as a duodenal tube is passed with greater ease and less discomfort to the patient, and is better tolerated by the stomach.

It is **indicated** in the following conditions:

1. In some operations on the jaw or tongue.
2. In insanity, when the patient refuses food and is in danger of starving. It is also given to fasting or hunger-striking prisoners for the same reason.
3. Where the feedings the patient is able to take are inadequate.
4. In strictures or spasms of the esophagus when the patient cannot swallow food.
5. In conditions in which patients are unconscious.
6. In tetanus.
7. In poisoning, to introduce an antidote for the poison.

The necessary *articles* will be the same as for a lavage with the exception of the flask containing the nourishment and as all the fluid is to be retained no pail will be required. Sometimes a syringe is used to withdraw a small amount of gastric contents to insure that the tube is in the stomach. When a small tube, such as a duodenal tube, is used a 15 to 20 c.c. glass syringe may be used in place of the larger funnel. The food usually consists of from 100 to 300 c.c. of concentrated, nourishing food such as milk, cream, eggs, etc. The *temperature* of the fluid should be about 105° F. It should always be tested to avoid the danger of burning the patient.

The tube is introduced in the same way as for a lavage. The stomach will probably try to get rid of it by contraction of its muscular walls at first, so before introducing the fluid, wait a few moments until the peristalsis or unrest has subsided. Allow the fluid to flow in slowly, and with no force so as not to excite peristalsis. Before all the liquid has left the funnel and tubing, pinch the tube and withdraw gently but quickly in order to prevent air from entering and also to prevent the entrance of fluid into the trachea.

After the treatment the patient should be left comfortable, quiet, and undisturbed, so as to avoid the expulsion of the nourishment.

A Nasal Gavage

In this method of feeding, liquid food is introduced into the stomach through a rubber catheter which is passed through the anterior and posterior nares and the pharynx into the esophagus. As the mouth does not have to be forced or kept open, when forced feeding is necessary this method is less exhausting.

It is **indicated** (1) when a patient is in a weakened condition and cannot swallow food; (2) sometimes in operations on the mouth, such as carcinoma of the tongue, a cleft palate or fracture of the jaw, etc.; (3) in operations on the throat and sometimes after a tracheotomy; (4) in tetanus or meningitis with a locked jaw; (5) in forced feeding for irritable or violent patients; (6) in very weak infants.

The *articles* required will be a medium sized rubber catheter (such as a No. 20 French catheter for adults, and No. 10 for infants), a small glass funnel or a glass syringe attached, in a basin of cold water, a lubricant, a flask containing the nourishment, cut gauze, a paper bag, dressing rubber and drawsheet.

The *position of the patient* may be lying down with the head turned to one side or sitting up with the head tilted forward. An infant should lie across the knees with its head turned away from the nurse. The catheter should be inserted in the uppermost nostril.

The *food* may consist of any liquid food which will readily pass through the tube.

The *temperature* of the liquid should be *warm* not hot. The lining of the nose is much more sensitive than that of the mouth and the danger of burning the patient is greater when feeding by this method.

Method of Procedure.—When inserting the catheter direct it toward the septum of the nose. First lubricate it. If there is difficulty in passing the tube remove it and insert it in the other nostril. The septum of the nose is frequently deviated or deflected, making the chambers of the nose unequal in size. The tube should reach into the esophagus, so pass all the tube with the exception of a few inches which are necessary in manipulating the funnel.

As the catheter is small there is considerable danger of its passing into the larynx, therefore when introduced observe the patient's color and breathing before pouring in the solution, which would drown the patient if the tube should be in the larynx. Even a small amount of food in the lungs, besides being the cause of severe irritation and dyspnea, if allowed to remain (that is, if not coughed up), would decompose and probably lead to a lung abscess or septic pneumonia. If the tube is in the trachea a whistling sound will be heard when the funnel is held to the ear, while if in the esophagus probably a gurgling sound.

As the tube is soft it may become coiled upon itself in the mouth or in the throat. If the fluid is poured in while the tube is in this position it will cause gagging, choking and gasping, and will almost certainly enter the larynx causing dyspnea, cyanosis and later a possible abscess and septic pneumonia. Look in the mouth or pass the finger to the back of the throat to see if the tube is in position.

Before pouring in the solution, wait until the parts are at rest, until all distress has subsided and normal breathing is established and to make sure that the tube is in the esophagus. Then as a further precaution pour in only a few drops at first, then pour the balance in very slowly if there are no symptoms of choking.

After all the fluid has left the funnel, pinch the catheter and quickly withdraw.

THE EXPRESSION OR SIPHONAGE OF THE STOMACH CONTENTS

The expression of the stomach contents consists in their withdrawal, by siphonage, through a stomach tube. An examination of the return is usually made for diagnostic purposes. The expression frequently follows the ingestion of a "test meal" after a suitable time. The test meal is given when the stomach is fasting.

This method of examination is **used in the diagnosis** of suspected diseases of the stomach such as (1) gastritis; (2) gastric ulcer; (3) gastric carcinoma; (4) dilatation; (5) hypersecretion and hyposecretion of gastric juice; (6) hypermotility and hypomotility (increased or decreased motor power or activity of the muscular walls).

These tests indicate (1) the motor power of the stomach; (2) the secretory activity and the rate and amount of digestion; (3) the absorptive activity.

The *motor* activity is the ability of the stomach to pass its contents into the small intestine in the normal time. It depends upon the condition of the food ingested, the tone of its muscular walls, and whether or not there is an obstruction at the pylorus. Normally after a full meal food begins to leave the stomach in half an hour, and in from four to seven hours all the food will have left the stomach.

The Secretory Activity.—Normally gastric juice is secreted only in response to some food stimulus. The secretion may be stimulated by (1) a psychical stimulus—the thought, odor or sight of food; (2) the tasting and chewing of food, particularly if palatable; (3) a hormone, or chemical messenger, in the saliva which, by the blood stream, reaches the stomach before the food, and, as it were, announces the coming meal and orders a supply of gastric juice; (4) the saliva itself, swallowed with the food may act as a stimulus and (5) some think the chief stimulus is the contact of the food with the mucous lining of the stomach. Probably all these factors contribute but with the test meal the last factor is most important.

The amount of gastric juice secreted is about 2000 c.c. per day. It is highly acid, containing hydrochloric acid (0.1 to 0.3 per cent.), salts, and the enzymes pepsin, rennin and lipase, but little solid matter. Mucus is also secreted by the mucous lining.

The *function of the hydrochloric acid* is:

1. To inhibit the growth of bacteria and neutralize the saliva.
2. To combine with the protein and make it possible for the pepsin to act.
3. (Free hydrochloric acid.) To close and keep up the tone of the cardiac sphincter, to open the pyloric valve and, when in the intestines, to close the pyloric valve and stimulate the secretion of the intestinal juices.

It will thus be seen that if there is a lessened amount or an absence of hydrochloric acid, no digestion of protein (the chief work of the stomach) can take place; the pyloric valve will not open; the undigested food will accumulate; bacteria will develop unchecked; fermentation and decomposition of the contents will result forming gases and organic acids; the stomach will dilate; the cardiac sphincter will lose its tone and eructations of gas and sour contents (heartburn) will occur. The amount of free hydrochloric acid in the return is therefore a very important indication.

The *pepsin* changes the acidified protein to proteoses and peptones.

The *rennin* in the presence of calcium salts changes the casein (protein of milk) into a soft curd so that the pepsin can more easily digest it.

The *enzyme lipase* may digest to a limited extent fats already emulsified, but it is believed that this enzyme is destroyed by the percentage of acidity present in the normal stomach.

Common Test Meals

1. **The Ewald Test Meal** is usually used for the routine test. It consists of a roll or slice of bread without butter, a glass of water or a cup of weak tea without sugar or cream. In giving any test meal instruct the patient to chew the bread or other solid food very thoroughly, otherwise coarse particles may remain undigested and be too large to enter the tube, or they may enter and plug it. The meal is given on a fasting stomach (usually early in the morning) and is expressed one hour later.

Much may be learned by observation of the return, and this the nurse should carefully note and chart.

The *macroscopic examination* reveals:

(a) *The amount and character of the return.* The normal amount (at the end of one hour) is from 20 to 50 c.c. of gastric contents. If there is little or no return, the result indicates *hypermotility.* The same result may occur in an hour-glass stomach.

At the end of two hours no trace of the meal should be left. If 200 to 300 c.c. of gastric contents are obtained, the result indicates a *diminished motility* or a *hypersecretion* of gastric juice. The contents may be undigested portions of the test meal, fluid and food partially digested, such as fruit skins, which have remained for some time in the stomach. Sometimes 500 c.c. up to three or four quarts are obtained. This points to diminished *motility* and *dilatation,* usually resulting from a benign or malignant obstruction of the pylorus. With *hypermotility* there may be no food.

In severe chronic gastritis little or no digestion may have taken place and there will be a great deal of mucus, usually dark brown and tenacious.

(b) The *color* may indicate the presence of blood, either bright red (a fresh hemorrhage) or "coffee ground," that is, mixed with the contents and giving it a "coffee ground" appearance due to an old hemorrhage and showing partial digestion of the blood. A *greenish tint* shows the presence of *bile.*

(c) The *odor.*—Normally after a test meal the contents have merely a slight acid odor. A *fecal odor* points to the presence of regurgitated fecal matter and may indicate intestinal obstruction. If the contents have a very *sour* odor it indicates the presence of acetic (sour odor) and butyric acids (putrid odor), which result from fermentation of stagnant contents in a dilated stomach. A *very foul odor* of putrefying flesh is sometimes present in carcinoma due to putrefaction and death of tissue.

A *microscopical examination* of such material will reveal the presence of mucus, fat, starch, pus, yeasts, bacteria, blood, elastic or muscle fibers, and carcinoma cells, etc.

The *chemical analysis* is to test (1) the *reaction* of the contents; (2) the amount of *free hydrochloric acid.* Normally the stomach secretes hydrochloric acid until a sufficient amount has combined with the food and continues to secrete until the free or uncombined acid reaches about 0.2 per cent. This is the most important test as the work of the stomach depends upon this acid and it is the ingredient usually increased or diminished. Normally after the Ewald test meal the average amount of free hydrochloric acid is 30 to 40 c.c., that is, based on the amount of alkali necessary to neutralize 100 c.c. of gastric contents, it would normally take 40 c.c. of alkali. In disease (hypersecretion) this may reach 80 to 90 c.c.; (3) the estimation of the *combined hydrochloric acid,* that is, the amount combined with the food. This varies greatly, but the average is from 10 to 15 c.c. (50 grams of bread will combine with 0.15 grams of acid); (4) the *total acidity*, which includes not only the useful and necessary hydrochloric acid, but also organic acids, such as lactic, acetic and butyric, which were either taken in with the food or resulted from fermentation in the stomach. In vomitus it is the presence of these acids which gives the very sour odor and which makes the mouth and lips, etc., of the patient so sore. Acetic and butyric acids are fatty acids (butyric acid is present in rancid butter). They indicate stagnation of contents with fermentation and an absence of hydrochloric acid which, if present, would check the bacteria which produce fermentation. These acids, although they provide an acid medium, aid digestion very little, if any, and even seem to interfere. The *total acidity*, then, may be high even in the absence of hydrochloric acid. It varies greatly; in health it may be 50 to 80 c.c. In disease it may be much higher (hyperchlorhydria) or it may be very low as is frequent in carcinoma. Further analysis will indicate the presence and activity of *pepsin*, *rennin* and *lipase* as indicated by the digestion of proteins and fats.

Hydrochloric acid is usually *decreased* (hypochlorhydria) in chronic gastritis, dilatation and acute infectious diseases.

Hydrochloric acid may be *absent* (achlorhydria) in advanced chronic gastritis, in carcinoma and in pernicious anemia.

Hydrochloric acid is usually *increased* (hyperchlorhydria) in gastric ulcer.

After the Ewald test meal the food is not allowed to remain in the stomach long enough to test the rate and amount of digestion.

2. The **Riegel Test Meal** consists of a plate of plain meat broth, 200 grams of tender beefsteak, 150 grams of finely mashed potatoes or two slices of white bread (or a roll), and a glass of water. Instruct the patient to chew this very thoroughly. The meal may be removed in from three to six hours. The advantage of this meal over the Ewald meal is that it is a normal meal, is more palatable and therefore stimulates a more normal gastric secretion due both to the pleasurable psychic effect (which is absent or even accompanied by an inhibitory effect in the Ewald meal), and also to the contact of the food with the lining of the stomach. It enables the doctor to tell how long food remains in the stomach after a normal meal, and also, as it is allowed to remain for several hours, to judge the rate and amount of digestion. If at the end of three hours, when the stomach tube is passed, no return is obtained, the motility is either normal or increased. If after four hours a large amount still remains and the food is undigested the motility is decreased and the digestive power is very poor.

A chemical and microscopical analysis may also be made as in the Ewald test meal.

3. **The Fasting Stomach Test.**—Sometimes to test the

motility of the stomach in dilatation or pyloric obstruction, the stomach tube is passed seven to eight hours after the last meal (when the stomach should be completely empty), to find out if any food is still retained. Again, all the stomach contents may be removed by a thorough washing (lavage) and the patient given food difficult to digest (such as raisins or fruit cake containing currants), and easily recognizable if not thoroughly digested,—these may be obtained in the siphonage days after.

4. The **Salol Test** is also used to test the motility of the stomach. It is based upon the fact that salol is only broken up into its constituents, phenol and salicyclic acid, by the intestinal juices. The salicylic acid is absorbed by the intestines and eliminated in the urine. One gram of salol in a capsule is given the patient after a meal and the bladder is emptied. If the *motility* of the stomach is normal or is not decreased, salicylic acid should appear in the urine in one to one and a half hours.

5. To test the **absorptive** power of the stomach, 15 grains of potassium iodid are given and the saliva is tested with a starch paste to detect the presence of iodin, which colors the starch blue. There is little, if any, absorption of food in the stomach, but some drugs, such as alcohol, iodin, etc., are absorbed. Iodin is eliminated in the saliva, which explains why patients receiving potassium iodid constantly complain of the disagreeable taste in their mouths, even though the taste of the drug may have been disguised in its administration. Normally, in six to ten minutes the starch paste turns a violet color, and in fifteen minutes a deep blue color indicates the presence of iodin in the saliva.

Method of Procedure.—The *articles* required to express the stomach contents will be the same as for a lavage with the exception that no solution will be required and a special receptacle for the return will be necessary.

To obtain the best results, if possible have the patient sitting up, with the head tilted slightly forward and the mouth slightly opened. The position must be natural and easy to facilitate swallowing of the tube. Insert the tube as for a lavage, taking all the preliminary precautions to explain the treatment and to reassure the patient. The greatest patience, consideration and skill will be required as the results depend upon it. There must be no haste or excitement. If the tube is not passed successfully on the first trial, allow the patient to rest a moment and recover, then try again, but do not tire the patient out.

When the tube is inserted sometimes there is difficulty in obtaining the return. Siphonage may be aided by pushing the tube in a little further or by pulling it out slightly. Ask the patient to cough, to lean forward and "bear down," to make pressure over the region of the stomach or to strain as in vomiting or at stool. This causes depression of the diaphragm (with pressure on the stomach), a closure of the glottis and a contraction of the abdominal muscles (with pressure on the stomach).

This is Nature's way of emptying the stomach in vomiting—a closure of the glottis, contraction of the diaphragm and abdominal muscles, causing forcible pressure on the stomach. If these measures are unsuccessful the contents will have to be removed by aspiration. This is accomplished by creating a slight vacuum by squeezing a rubber bulb in the tubing or by attaching a Politzer bag to the tube and creating suction.

As the test for the acidity of the contents expressed is the most important factor from a diagnostic standpoint, it is essential that the saliva from the mouth (which is alkaline and greatly increased by the passage of the tube) should not become mixed with the return, as it would neutralize the acid and render the test useless. To prevent this wrap a towel around the tube so that it will absorb the saliva as it runs from the mouth.

When withdrawing the tube ask the patient to cough again so as to force the remains of the meal or gastric juice into the stomach tube. Then compress the tube so that none may be lost and rapidly but gently remove it. Keep the tube compressed until all the return is transferred to the special receptacle for it.

The stomach contents must be carefully covered and sent to the laboratory immediately. It must be kept on ice until examined to prevent further action of the enzymes, fermentation, putrefaction, or any alteration in the contents. This would render the analysis useless or would lead to very faulty conclusions.

In *charting* the procedure, note the amount, character, odor and color of the return. Note also that a specimen was sent to the laboratory for examination.

Summary of the Results.—*Ulcer.*—The presence of blood and free hydrochloric acid is very suggestive.

Dilatation.—The retention of food for 24-48 hours; vomiting large amounts; diminished hydrochloric acid; organic acids present, and bacteria are suggestive.

Carcinoma.—Diminished motility and hydrochloric acid; the presence of bacteria, yeasts, blood, organic acids and tumor cells are suggestive.

Chronic Gastritis.—Increased mucus and diminished ferments suggest chronic gastritis.

Hypersecretion.—Increased gastric juice in a fasting stomach; increased hydrochloric acid after test meals are suggestive.

CHAPTER XXVII

NURSING IN THE TREATMENT OF INFLAMMATORY DISEASES

BY

THE ADMINISTRATION OF MEDICINES

The administration of medicines is one of the most responsible duties assigned to student nurses. As a rule, such responsibilities (except the giving of simple, relatively harmless remedies) are not given a student until she has had instruction in materia medica and medical diseases, and has had considerable experience in the observation and care of patients. Without such knowledge and experience it is not safe for even the most conscientious student to administer drugs, the purpose and effects of which she is ignorant of. This duty is therefore only assigned to an experienced nurse trained to understand the dangers and responsibility involved.

The **responsibilities of the nurse** are to see that the medications are received by the patients accurately, promptly and in such a way as to give the best results. In order to do so intelligently she should consider the nature of the drug, its action, local and systemic, in the body, to what its action is due, the maximum and minimum dosage, the factors which modify the dosage and its effect, the disease from which the patient is suffering, the effect desired, why the drug is being given, and the symptoms which indicate the desired and possible undesired results. She should also know and watch for symptoms of overdosage because (a) some people show an idiosyncrasy and susceptibility to certain drugs, (b) some drugs are very slowly excreted and when continued may cause cumulative poisoning, (c) some drugs are "pushed to their physiologic limit," that is, until the first symptoms of overdosage appear.

She should also know the treatment for poisoning by the various potent drugs. To be familiar with the habit-forming drugs and the necessity for, and the means of restricting their use are also important responsibilities of the nurse.

To give drugs—all of which are more or less undesirable, many of them highly injurious and poisonous, the last remedy to be considered by modern doctors and used as sparingly as possible—in any other way is a dangerous procedure. No nurse should dare to be ignorant, disinterested or mechanical in the administration of drugs. As with other practical procedures, the classroom should not be relied upon by the student for the study of pharmacology and the administration of medicines. The ward is the ideal place where each drug can be studied in relation to the individual patient and disease.

Accuracy, Punctuality and Efficiency.—To insure that the right patient is given the right medicine at the right time, each hospital has developed or adopted a definite system for the administration of medicines which usually includes the following:

The Doctor's Order-Book.—On each ward there is usually a book in which all the doctor's orders are written. Except in extreme emergencies no medication should be given a patient unless the order is written in this book (a nurse may write the order dictated) and signed by the doctor. When an emergency prevents this the order should be written and signed later. All orders must be clearly written. A nurse should never give a medication if in doubt as to the drug or dosage. When a nurse goes to the operating-room for a patient she should take this order-book with her so that orders may be written and signed there. Sometimes there is a separate order-book for day and night, but in any case the date, and whether the medications are ordered during the day or night should be clearly indicated. Nurses should look at this book frequently because a doctor may write an order without calling the attention of a nurse to it and the patient may be suffering for want of the medication. When a medication ordered is not to be repeated, when given it should be marked off with red ink indicating the time when given. The order and the time are copied on the chart. If such an order is not marked off the drug may be given a second time and endanger the life of the patient. Those which are to be repeated are marked off when the order is transferred to the medication tickets or cards used for convenience and accuracy in administration. Colored tickets (2 inches square) are commonly used, each color indicating the time of administration as in the following:

Color of Ticket	*Time of Administration*
Plain yellow	Every four hours
Yellow with corners cut	Four times a day
Plain pink	Three times a day
Pink with corners cut	Every three hours
Orange	Before meals
Orange, ½ ticket	Every night
Blue	After meals
Pale orange	Twice a day
Red	Every six hours
Red, ½ ticket	Every morning
White	Every two hours
Green	When required

Medications to be given by hypodermic injections must be designated on the ticket.

When this system is used the orders should be transferred from the order-book to the tickets by the headnurse or, if by a pupil nurse, checked by the headnurse. The patient's name and the medication must be clearly written. The tickets must be kept clean and legible. They should be safely locked in the medicine cupboard. The headnurse should have a record by means of which she can daily check the number of medications given at different hours. When a medication is altered or discontinued the ticket is placed on the desk and destroyed by the headnurse. The headnurse should daily check the order-book, the medication tickets and the patient's chart to see that all agree. The tickets should be arranged in packets according to the colors or time of administration. When the medications are to be given out, the nurse places the tickets in a row and, as the medication is prepared, attaches the ticket to the glass and does not remove it until the medicine is given to the patient. The tickets should then be placed on the headnurse's desk to indicate that the medications have been given.

Abbreviations.—In writing orders or medication tickets and in charting, abbreviations are always used so that a nurse must become familiar with the following:

Preparations of Drugs

Abbreviation	*Derivation*	*Meaning*
Aq.	aqua	water
aq. dest.	aqua destillata	distilled water
Comp.	compositum	compound
Conf.	confectio	confection
Dil.	dilutus	dilute
Empl.	emplastrum	plaster
Fl.	fluidum	fluid
Inf.	infusum	infusion
Lin.	linimentum	liniment
Liq.	liquor	liquid
Lot.	lotio	lotion
Mist.	mistura	mixture
Ol.	oleum	oil
Pil.	pilula	pill
Pulv.	pulvis	a powder
S. fr.	spiritus frumenti	whisky
Sp.	spiritus	spirit
S. v. r.	spiritus vini rectificatus	alcohol
S. v. g.	spiritus vini gallici	brandy
Syr.	syrupus	syrup
Tinct.	tinctura	tincture
Troch.	trochiscum	lozenge
Ung.	unguentum	ointment
Vin.	vinum	wine

Directions for Dosage and Application

Abbreviation	*Derivation*	*Meaning*
āā	ana	of each
Add.	adde	add to
Add. part. dol.	adde partem dolente	to the painful part
ad. lib.	ad libitum	as much as desired
C.	congius	gallon
C.		centigrade
c̄.	cum	with
C. c.		cubic centimeter
Cap.	capiat	let him take
Contin.	continuatur	let it be continued
Dim.	dimidius	one-half
D. in p. aeq.	dividatur in partes aequales	divide in equal parts
Div.	dividatus	divide
Dur. dolor.	durante dolore	while the pain lasts
Ft.	fiat	let it or them be made
Gm.		gram, grams
gr.		grain, grains
gtt.		drop, drops
Garg.	gargarisma	a gargle
M.	misce	mix
M.		minim
N.b.	nota bene	note well
No.	numero	number
O.	octarius	a pint
Part. vic.	partibus vicibus	in divided doses
Q.s.	quantum sufficit	as much as is sufficient
℞	recipe	take
s̄.	sine	without
S. or Sig.	signa	give the following directions
S.o.s.	si opus sit	if necessary
Ss	semi	one-half
ʒ	drachma	dram
℥	uncia	ounce
℈	scrupulum	a scruple

Directions for Time of Administration

Abbreviation	*Derivation*	*Meaning*
A.c.	ante cibum	before meals
Alt. die.	alternis diebus	alternate days
Alt. hor.	alternis horis	alternate hours
Alt. noct.	alternis noctes	alternate nights
Am.		morning

Directions for Time of Administration

Abbrevation	*Derivation*	*Meaning*
B.i.d.	bis in die	twice a day
H.	hora	hour
H.d.	hora decubitus	at bedtime
H.s.	hora somni	at sleeping time
Min.		minute
M. et N.	mane et nocte	morning and night
O.d.	omne die	daily
O.m.	omne mane	each morning
O.n.	omne nocte	each night
P.c.	post cibum	after meals
P.r.n.	pro. re nata	when required
Q.h.	quaqua hora	every hour
Q.2 h., Q.3 h. Q.4 h.		every two, three or four hours
Q.i.d. or 4 i.d.	quater in die	four times a day
Stat.	statim	at once
T.i.d.	ter in die	three times a day

Hours of Administration

4.i.d.	8 a. m., 12 n., 4 p.m., 8 p.m.
q. 2 h.	6, 8, 10, 12, etc.
q. 3 h.	9, 12, 3, 6, etc.
q. 4 h.	8, 12, 4, etc.
q. 6 h.	6, 12, etc.
B.i.d.	10 a.m., 4 p.m.
T.i.d.	10 a.m., 3 p.m. and 6 p.m.
A.c.	½-hour before meals—6:30 a.m., 12:30 p.m., 4:30 p.m.
P.C.	8 a.m., 2 p.m., 6 p.m.
O.d.	10 a.m.
O.m.	6 a. m.
O.n.	8 p.m.

The Medicine Chest.—Accuracy, punctuality and efficiency are greatly facilitated by a properly arranged medicine cupboard. If possible, it should be near the ward and near running water. It should always be locked, the key properly tagged and kept in a safe place, to which only nurses and doctors have access. The cupboard should be divided into compartments with ample shelf spacing. Solutions, ointments, liniments, etc., for external use should be in separate compartments. Substances for internal use should also be in separate compartments; solids and liquids are kept separately; poisons should be kept separately and should be in bottles differentiated by color, roughened surface or shape and clearly marked *poison;* all potent drugs such as morphin, strychnin, etc., usually given hypodermatically, should be in a separate compartment; as far as possible drugs used for a similar action should be grouped together—cathartics, respiratory preparations, sedatives, etc. Oils should be kept in a cool place—they are decomposed by heat and made rancid by exposure to air. Sera and vaccines are kept in the ice box. The cupboard should be well supplied with all the drugs likely to be required, but it should never be overstocked. Its contents should be examined daily. Day nurses should see that there is sufficient for the needs of the day and should be particularly watchful to see that the necessary supply is provided for the night. Drugs should be ordered in small amounts as many deteriorate or lose their effect if not fresh. Any change in color, odor or consistency should be reported. Bottles should be securely corked and labeled. Labels should be printed and always clean. No nurse, however, should ever alter or change the labels—this should be done by the pharmacist only. To avoid soiling the label, when pouring the solution from the bottle the label should be held uppermost. The rim of the bottle should always be cleansed afterwards. Medicine should never be left in a glass or bottle unmarked. If a drug has two names, commonly used, it is wise to have both names printed on the label. The dose of potent medicines is sometimes printed on labels. Cupboards, shelves, bottles, labels, etc., should be immaculately clean and orderly. Bottles should be of a uniform size and shape, not crowded, and arranged so that each label is clearly visible. To avoid overcrowding and confusion, prescriptions ordered for special patients, if discontinued or if the patient is discharged, should be returned to the drug room.

Method of Administration.—The physician prescribes the medication, the dosage, the time of administration and the channel through which it is to be given. Like all other treatments, however, the effects of the medication will depend upon the intelligence, accuracy and care with which it is prepared and administered to the patient.

Factors Modifying the Dosage and Effects of Drugs.—A nurse is not responsible for the dose ordered but she is held responsible for seeing that by no possible error will the patient receive an amount which he is not intended to have. For this reason, she should know the maximum and minimum dosage of the various preparations of drugs likely to be ordered and the factors which modify the dosage and effect upon the patient. Some of these factors are:

1. *Age.*—As it is impossible to learn the dosage for all ages, various rules have been formed for estimating the dose for a child from the adult dose. The rules are usually based on the age and weight. Young's rule, which is one commonly used is, $\text{Adult dose} \times \frac{\text{age}}{\text{age} + 12}$. Such rules do not always apply because

children react differently to different kinds of drugs. For instance, "children react strongly to opium and other narcotics, while on the contrary, the child's dose of a cathartic or belladonna or arsenic approaches that of an adult. In old age, the dose of drugs which are weakening or depressing, such as irritant cathartics or narcotics, is smaller than the usual adult dose."

2. *Sex.*—The adult dose is based upon the average weight of a man. As women weigh less than men, the dose ordered is often smaller.

3. *Previous Habits or Toleration.*—When a patient has been in the habit of taking drugs such as morphin or alcohol it is often dangerous to stop the use of the drug suddenly. When given, larger doses are necessary to produce any effect. For instance, following an accident or in pneumonia, when the patient has been in the habit of drinking, whisky will be administered to prevent delirium tremens. If morphin is given in the same conditions to relieve pain or to quiet the patient and produce sleep, larger amounts will be necessary if the patient has been in the habit of taking morphin. Patients quickly develop a tolerance for all sedative drugs.

4. *Idiosyncrasy and Susceptibility.*—Certain foods and drugs, which may be given to most people with safety, produce in others very unusual and poisonous effects. For instance, some people have a decided intolerance for cocain or opium so that even small doses of these drugs produce toxic symptoms.

5. *Temperament and Occupation.*—Patients of a neurotic temperament and easily excited are more susceptible than those who are stolid or of a phlegmatic temperament. Patients whose habits have been sedentary are more apt to be susceptible than those hardened by an active out-door life.

6. *Condition of the Patient.*—When pain is great, large doses of morphine may be ordered. When the patient's breathing is already difficult, smaller doses of morphin will be given and the patient will be closely watched for further depression of the respiratory center. In shock or collapse the dosage of stimulants ordered may be larger than usual. When drugs are given as an antidote for poisoning large doses are ordered. On the other hand, in diseases of the kidneys or in any disease with edema smaller doses may be ordered and at greater intervals. Failure of the kidneys to eliminate the drug will cause it to accumulate in the body with poisonous results. In edema the drug may be dissolved and accumulate in the excess fluid and as the fluid is eliminated, large amounts of the drug may be suddenly dumped on the tissues with poisonous results. In such diseases the nurse should watch the patient closely for symptoms of cumulative poisoning.

7. *Nature and Form of the Medication.*—The effect of some drugs, such as ammonia, nitrate and adrenalin, .wears off very quickly so that they are given more frequently. Other drugs, such as digitalis, are absorbed and eliminated slowly so that

they are given less frequently in order to avoid cumulative poisoning.

Medications in liquid form or well dissolved are absorbed and act more rapidly than when in solid form. For this reason when pills or tablets, etc., are given, plenty of water should also be given to help dissolve them and to aid in swallowing. When pills, etc., are not fresh they should be crushed into a powder to be sure that they will be properly dissolved. *Urotropin* should always be crushed into a powder and well dissolved in a medicine glass of water. The antiseptic effect of urotropin is due to the formaldehyde contained in it. The drug must be thoroughly dissolved and broken up in order to liberate the formaldehyde. All *powders* are best dissolved in water. For this reason, many doctors object to having bicarbonate of soda given in a capsule. It should be dissolved in a medicine glass of water. When powders will not dissolve in water they should be allowed to float on water in a glass or spoon or placed on the back of the tongue and washed down with a glass of water.

8. *Object of the Medication.*—A large dose of ipecac acts as an emetic whereas a small dose acts as an expectorant.

9. *Time of Administration.*—The effect of drugs is much more marked when given on an empty stomach. For instance, alcohol on an empty stomach may intoxicate, but when taken during or after a meal may aid in digestion but produce no systemic effects. Larger doses of drugs are, therefore, usually necessary after meals to produce the effect desired.

10. *The Channel of Administration.*—The dose varies with the rapidity with which it is absorbed. For instance, when given intravenously the dose is small because the full effect of the drug is felt immediately. When given by rectum the dose ordered may be larger than when given by mouth because it is felt that the rate and amount of absorption is generally less rapid and certain.

To *insure accuracy* in the administration of drugs, when preparing and giving medications, a nurse must concentrate on what she is doing and allow no conversation or interruption of any kind. She should read each ticket carefully, think about the nature of the drug, the condition of the patient, the desired effect and how best to obtain it. The label on the bottle should be read three times—before taking the bottle from the shelf, before pouring out the medicine and before returning the bottle to the shelf. Immediately place the corresponding ticket with the glass. This careful check in reading of labels is essential. Failure to do so has led to fatal results. The nurse, only, should give the medication to the patient and she should remain with the patient to see that it is taken. Always use the proper apparatus for measuring or weighing—use graduated glasses for measuring ounces or drams, a minim glass for minims, and a pipette or medicine dropper for drops. Never give drops for minims or vice versa. When measuring fluids hold the graduate so that the eye is on a level with the line indicating the desired quantity. Measure the exact amount ordered. Never pour a medicine back into a bottle. Always shake the bottle before pouring the medicine, particularly when there is a precipitate. Medicines which, when mixed, change color or form a precipitate should not be given at the same time without reporting this fact to the doctor. They are said to be incompatible, due to the chemical reaction which occurs when they are mixed. All medicines should be given promptly at the time ordered.

Channels of Administration.—Medications may be administered by one of the following channels:

1. Intravenously.
2. By inhalation.
3. By hypodermoclysis.
4. By intramuscular injection.
5. Subcutaneously.
6. By mouth.
7. By rectum.
8. By inunction.

The channel by which medications are administered depends upon the effects desired, the rapidity of action necessary, the nature and amount of the drug to be given and the condition of the patient.

The *desired effect* may be a *direct local effect, a systemic effect,* or a *remote local effect.* For instance, bicarbonate of soda is given for a direct local effect when given to neutralize acid in the stomach, and for a systemic effect when given to neutralize acids in the blood, as in acidosis. Opium is given for a direct local effect when given by rectum to relieve pain as in hemorrhoids. It may also be given by rectum to produce a sedative effect on the whole system through its action on the nervous system. Ipecac (a large dose) is given for a direct local effect on the stomach when given to cause vomiting, but for a remote local effect when a small dose is given as an expectorant. In the latter case the drug is absorbed and eliminated partially through the respiratory system. Urotropin, given as a urinary antiseptic, is another example of a drug given by mouth for a remote local effect.

Drugs given for a systemic, or remote local effect, must be absorbed into the general circulation. According to the rapidity with which the action is desired, the nature and amount of the drug to be given, and the condition of the patient, drugs are given by one of the following channels:

1. **Intravenously.**—When an immediate action is desired the drug may be given directly into a vein. It may be dissolved in a small amount of normal saline solution and given by *intravenous injection* or added to a large amount of normal saline or other isotonic solution and given by intravenous infusion. For the method of giving an intravenous infusion, see Chapter XXXII.

Salvarsan and neosalvarsan are drugs usually given intravenously.

Salvarsan and Neosalvarsan.—Salvarsan (arsphenamine) and neosalvarsan (neoarsphenamine) are preparations of arsenic used chiefly in the treatment of *syphilis.* Salvarsan is also used in sleeping sickness, relapsing fever, malaria, pernicious anemia, leukemia and other diseases.

Salvarsan is also used as an aid to diagnosis in suspected syphilis when the Wassermann tests have been negative. Following the injection, if the condition is syphilitic, the Wassermann test may be positive. When used in this way it is called a "provocative dosage."

It is thought that the above preparations indirectly destroy the spirochæte pallida causing syphilis and not directly, as was at one time thought, by combining with and destroying the protoplasm of the organism.

Salvarsan is commonly called 606, because this number represents its place in the series of compounds prepared by Ehrlich, as neosalvarsan is represented by 914.

The dosage of salvarsan varies from 0.2 gramme (3 grains) to 0.6 gramme (10 grains) depending upon the age, sex, and general health of the patient, and the character of the disease. The dosage of neosalvarsan varies from 0.15 gm. to 1.5 gm. They are given at intervals varying from four days to two weeks, commonly one week.

Method of Administration.—The drugs are sometimes given intramuscularly or subcutaneously, but more frequently, intravenously.

Salvarsan is a diacid solution and before use must be made into a sterile solution of slightly alkaline or neutral reaction. A 15 per cent. solution of sodium hydroxid is added for this purpose. The dose (0.6 gm.) is dissolved in a small amount of sterile normal saline solution to which 23 drops of the sodium hydroxid solution are added. To this, sterile normal saline solution is added, making 300 c.c. in all.

The injection may be given with the same apparatus and should be given with the same aseptic precautions as in giving a transfusion or intravenous injection. The preparation of the patient and precautions used in injecting the solution are the same. Plain normal saline may be injected first to insure that the needle is properly inserted in the vein (so that it will not enter the tissues with resulting irritation and inflammation), and after the injection to be sure that none is left in the vein.

Neosalvarsan may be administered with much greater ease as it readily dissolves in water and is already of neutral reaction. The drug is dissolved in freshly distilled cold (room temperature) sterile water (sometimes in normal saline solution). Heating the water is said to alter the drug, producing toxic properties. The preparation of the patient is the same as above. The only articles necessary for the injection are a sterile glass to mix the solution, a large glass syringe, and a short piece of sterile rubber tubing, to which the needle is attached.

Both salvarsan and neosalvarsan should be used only when fresh. They oxidize readily and so deteriorate rapidly and become poisonous.

Before the injection, in either case, the stomach and bowels should be empty. Afterward the patient should rest quietly in the recumbent position for several hours.

An injection of salvarsan may be followed by a severe reaction with headache, nausea, malaise, severe pain, and chills. The patient and the urine should be watched closely for several days following (especially in disease of the kidneys) as the arsenic, which is very irritating, is eliminated by the kidneys and may cause suppression. Several days later a further reaction may occur with dizziness, deafness, stupor, and sometimes unconsciousness. These symptoms are thought to be due to irritation of the nervous system by the toxic products set free from the parasites killed by the injection of salvarsan. Symptoms of arsenic poisoning, diarrhea and skin eruptions, etc., may also develop.

Neosalvarsan is said to be less toxic, but may be followed by a reaction with chill, fever, and impaired heart action.

2. **Through the Lungs by Inhalation.**—Drugs may be given by inhalation for either a local or systemic effect. The systemic effect is produced immediately because of the large surface area of the lungs and rich supply of blood vessels. Medicated steam is given for a direct local effect. The method of administration is discussed in the chapter on Diseases of the Eye, Ear, Nose and Throat. Inhalations of fumes from burning calomel are sometimes given for a direct local effect in syphilitic conditions of the throat. Fumes from stramonium leaves may be inhaled for a direct local effect on the bronchial tubes in asthma. Ammonia gas from ammonia water or smelling salts, amyl nitrite and oxygen are all inhaled for a systemic effect. Ether, chloroform and nitrous oxid gas are inhaled for a general anesthetic effect. The method of administering anesthetics may be learned from textbooks on surgery.

Method of Administration.—*Ammonia gas* is inhaled as an emergency heart and respiratory stimulant in fainting or mild collapse. Extreme care should be taken to protect the eyes and to avoid too strong or prolonged administration as the gas is extremely irritating. Cold compresses may be used to protect the eyes.

Amyl nitrite is given by inhalation to relax the coronary arteries and relieve an attack of angina pectoris or to relax the spasm of the muscles of the bronchial tubes in asthma. The drug comes in small glass capsules or "pearls," each containing mimims three to five, which should be broken in a handkerchief or gauze wipe and held to the nose of the patient for a few minutes only. The patient's face becomes flushed, the breathing more rapid, the pulse rapid and soft, showing that the blood vessels are relaxed. The patient complains of fullness and throbbing in the head. If too much is given he will suffer from severe headache due to excess blood in the head.

Oxygen gas is given by inhalation, most commonly in conditions such as pneumonia or edema of the lungs, accompanied by cyanosis, and in failure of the circulation. It is also used in bronchitis, anemia, phthisis and asphyxiation from coal-gas. The patient's critical condition indicates the extreme care with which the gas should be administered in order to get the best results. The oxygen is contained in an "oxygen tank" under compression. For administration the gas is passed through a bottle of water which is fastened to the tank. This bottle contains a rubber cork through which two glass tubes are inserted. One tube is long and extends well into the water. This tube is connected by rubber tubing to the outlet of the oxygen tank. The second glass tube is short, extending only to within an inch or two of the water. To this tube is attached a long piece of rubber tubing (long enough to reach to the patient) with a funnel attached. In this way the gas is made to pass through water before reaching the patient. The purpose is (1) to moisten the gas; (2) to indicate, by the bubbles formed, the rate and amount of gas passing through so that it may be regulated. The rate and amount should be sufficient to make small bubbles only. Otherwise the gas will be wasted.

The nurse must see that the tubes are properly connected. Otherwise the cork will be blown out of the bottle, causing waste of oxygen and unnecessary delay in its administration. She must see that it is properly regulated and administered. The funnel should be held at the side of the patient's face a little above the nose, and tilted slightly forward so that a stream of oxygen will flow continuously over the face. If held directly in front of the face it should be at least two or three inches away. Otherwise the patient will be forced to inhale again the air exhaled from his own lungs. In directing a stream of oxygen, it must be remembered that this gas is heavier than air. If the funnel is held below the nose and directed downward the patient will receive none of the oxygen and the gas will be wasted.

The inhalation is continued until the symptoms of cyanosis, etc., are relieved. Oxygen tends to dry mucous membranes. The patient's lips and mouth should be frequently moistened. Sometimes steam inhalations are given at the same time as the oxygen in order to prevent the drying and irritation of the mucous membrane of the respiratory tract.

When oxygen inhalations are necessary a nurse should see that there will always be a sufficient supply on hand. A second tank should be in readiness for immediate use when required. Any delay would endanger the life of the patient.

Calomel inhalations are sometimes given in syphilitic conditions of the throat. A canopy is arranged over the patient to prevent the escape of the calomel fumes. The powdered calomel is placed on a tin plate which is kept hot by means of an electric stove or alcohol lamp. The amount of calomel and the duration of the treatment should be ordered by the doctor. The patient should be closely watched during the procedure. The nurse must avoid inhaling the calomel fumes as, in a normal person, this would cause mercurial poisoning, the early symptoms of which are a profuse flow of saliva with soreness and bleeding of the gums.

Stramonium Inhalations.—Stramonium leaves may be made into cigarettes or burned in a receptacle which will not be broken by the heat. The fumes may be inhaled through a cone fitted over the receptacle. They relax the spasm of the involuntary muscles of the bronchial tubes in asthma.

3. **By Hypodermoclysis.**—By this method large amounts of a normal saline or other isotonic solution may be injected into the loose subcutaneous tissue under the breasts or in the abdomen, back or buttocks. The rate of absorption will depend upon the condition of the circulation and the tissue needs. The fluid should be rapidly absorbed, otherwise the mechanical pressure caused by its accumulation may cause death of tissue cells and gangrene. For the method of giving a hypodermoclysis see Chapter XXXII.

4. **By Intramuscular Injection.**—Irritating drugs such as mercury salicylate, ergotin, digitalis and sometimes camphor are injected deep into the muscles of the buttocks, back, chest and sometimes the limbs. When given in this way they are usually readily absorbed, depending upon the circulation. If given subcutaneously they are less readily absorbed so that they are very painful and are apt to produce sterile abscesses owing to their irritating effect on the tissues. The injection is made with a large, firm needle attached to a hypodermic syringe. The air is expelled from the syringe and the needle is inserted straight into the tissues. The part should be prepared as for a hypodermic injection and thoroughly massaged after the injection to hasten absorption. Intramuscular injections are usually given by a doctor.

When a patient is receiving repeated injections of mercury salicylate he should be closely watched for early symptoms of poisoning. These are an increased flow of saliva and sore, tender or bleeding gums. The mouth should receive very careful attention.

5. **Subcutaneously** (hypodermatically).—Certain drugs may be injected under the skin when (1) a rapid action is desired, and (2) when, for any reason, it is inadvisable or impossible to administer the drug by mouth. Only such drugs which are readily dissolved and absorbed and which may be given in a concentrated form or small bulk may be used. A large amount given in this way would cause pressure and injury to the tissues. All drugs used for hypodermic injection must be pure and sterile.

They are put up in the form of tablets or in solution ready for use.

Dangers to be Avoided in Giving a Hypodermic Injection.—(a) The *formation of a sterile abscess* from an irritating drug or an infective abscess from an unsterile syringe, needle, solution, or the unclean skin of the patient or hands of the nurse.

To avoid an infective abscess, the nurse's hands should be clean, the solution, syringe and needle must be sterile and the patient's skin where the injection is to be made should be cleansed and disinfected with alcohol.

To avoid a sterile abscess and the resulting pain, when giving an irritating drug such as camphor, the needle is directed straight into the fleshy parts such as the buttocks and thighs. As in all hypodermic injections, the part should be rubbed briskly before the injection in order to bring the blood to the surface so as to hasten absorption and prevent irritation. All drugs must be thoroughly dissolved. After the injection gentle massage also hastens absorption.

(b) *Injury to a Superficial Vein or Nerve.*—To avoid this the injection is given into the fleshy parts such as the front of the thighs, the outer surface of the arm or forearm, avoiding the course of the blood vessels or nerves.

(c) *Breaking the Needle in the Tissues.*—A bent needle should never be used. The injection should never be made over a bone, not only so as to avoid the danger of breaking the needle but, also, of causing injury to the periosteum. To avoid the danger from a sudden, jerky movement, it is always wise to explain to the patients what you are going to do, assuring them that they will merely suffer the slight pain from the prick of the needle. A nurse should never attempt to give a hypodermic injection to a delirious patient without the assistance of another nurse.

(d) *Pain.*—To avoid pain a sharp, clean needle only should be used. It should be inserted quickly as this causes less pain than when slowly inserted. The needle and the drug should be injected under and not into the skin so as to cause absorption and at the same time to avoid irritation of the superficial nerves in the skin. For local treatments when a local anesthesia is desired, cocain is injected into the skin under the epidermis (intracutaneously) to deaden these superficial nerves. When making a hypodermic injection, in order to avoid injecting the drug into the skin or superficial tissue, a cushion of flesh should be grasped between the left thumb and forefinger. The flesh should be firm and the skin tight and smooth. If the skin is wrinkled the injection cannot be properly made. The needle should be slanted at an angle of about 45 degrees and inserted its full length, then withdrawn slightly and the fluid injected slowly and gently. After a slight pause the needle is withdrawn gently. A sponge is held over the point of injection for a moment and the part is then gently massaged to hasten absorption.

Method of Preparing the Needle and Syringe.—The technique used should always be as simple as possible. In an emergency it will be necessary to give the medication without the loss of a single moment. At all times simplicity makes for efficiency and lessens the danger of infection. The method of preparing the syringe will depend upon the kind used. When the syringe is made of glass both needle and syringe may be sterilized by boiling for one minute. For emergency use a sterile syringe and needle may be kept in a package wrapped in a sterile gauze wipe. When a metal syringe or a glass syringe with a rubber washer is used, it must be sterilized by alternately drawing up and expelling alcohol 70 per cent. The needle may be attached to the syringe and sterilized in the same way or it may be placed in a spoon, covered with water and boiled over an alcohol lamp. For emergency use or when used for a patient at frequent intervals, the syringe and needle may be kept sterile by immersion in a solution of alcohol 70 per cent.

Method of Preparing the Drug.—When sterile tablets are used they must be dissolved in distilled water. Ordinary tap water may contain salts which alter the nature of the drug. The water should be boiled in a spoon. The tablet should be dropped from the bottle directly into the water so as not to contaminate it. When the drug is thoroughly dissolved it may be drawn up into the syringe. When the piston can be removed from the syringe the tablet may be placed directly in it and sufficient sterile water drawn up to thoroughly dissolve it.

Solutions for hypodermic injections are put up in sterile bottles with a rubber stopper. Before withdrawing the solution the rubber stopper is disinfected by immersing it in alcohol 70 per cent. The sterile needle, attached to the sterile syringe, is plunged through the rubber and the required amount is withdrawn. The needle is then covered with a sterile sponge saturated with alcohol and the medication is carried to the bedside. The air is expelled from the needle and syringe and the injection is given with the above-mentioned precautions.

After use the needle and syringe should be sterilized as before. The needle should be thoroughly dried, to prevent rusting, by repeatedly inserting and drying the wire which accompanies the needle. When dry the needle is put away with the wire inserted. The articles necessary for a hypodermic injection are usually kept on a tray. Before putting the tray away a nurse should see that it is fully equipped, ready for instant use.

6. **By Mouth.**—Medications are given by mouth in solution or in the form of pills, tablets or capsules, etc. In giving remedies a nurse should consider the following important factors:

(a) The effect desired and how to obtain the best results.
(b) The nature of the drug and its possible injurious effects.
(c) How to make the dose as palatable as possible.

Effect Desired.—It is important to know why a medication is being given in order to know whether it should be well diluted or given in a more concentrated form. All drugs given for a systemic or a remote local effect, and, therefore, to be absorbed, should be well diluted in order to aid absorption. Water is the best solvent. Unless otherwise ordered all drugs (except oily preparations) are given with water. The effect desired also governs the time of administration prescribed by the doctor. Drugs intended to be absorbed are usually given after or, if altered by the gastric juice, between meals because there is more blood in the stomach and intestines and absorption is taking place. For instance, sodium bicarbonate, when given for acidosis, is usually given between meals. If given after meals it is broken up by the gastric juice, combined with hydrochloric acid, and absorbed as sodium chlorid. It should never be given in a capsule but should be dissolved in a glass of water or in a medicine glass of water and followed by more water.

Water should be given freely with all drugs given for a diaphoretic, diuretic or narcotic effect, etc. A hot drink following the administration not only aids absorption but also aids the action of the drug. After giving such drugs as the salicylates, Dover's powder and other opium preparations which cause increased perspiration care should be taken to prevent the patient from becoming chilled. To give narcotics intelligently a nurse should know the time taken by the various drugs to act. She should see that the patient's surroundings and his mental and physical condition are all inducive to sleep and that nothing occurs to disturb his sleep. The depressing effect of all narcotics should be remembered. The patient should be closely watched and the character of the sleep noted.

Some drugs, such as aromatic spirits of ammonia, although given for a systemic effect, do not owe their stimulating action to absorption but to a reflex action following the irritation of nerve endings in the mucous lining of the mouth, etc. Such drugs must be diluted sufficiently to prevent irritation to the tissues, but not to the extent of preventing the irritation of the nerve endings. One-half to one dram of aromatic spirits of ammonia in one-half a medicine glass of water gives about the proper proportion.

Syrup cough mixtures given for a soothing or sedative effect on the mucous lining of the respiratory tract are usually given undiluted.

Drugs given for a local effect on the stomach are only slightly diluted. They may be given before meals when the stomach is empty and at rest to soften mucus, etc., or to stimulate the flow of gastric juice. They may be given during or after meals to supply a deficiency of hydrochloric acid or enzymes or to counteract abnormal conditions present. For instance, bicarbonate of soda given before meals will soften mucus and stimulate the flow of gastric juice. During and after meals it will neutralize hyperacidity. Drugs are usually diluted with cold water, but when a drug, such as peppermint, is given for a carminative effect hot water should be used. The heat greatly aids in the expulsion of gas from the stomach or intestines.

Many other examples might be given to show that the effect of any medication depends not only upon the nature and action of the drug but also upon the method of preparing and giving it to the patient. For this the nurse is entirely responsible. She should not give a medication without finding out why it is being given and the effect desired.

Nature of the Drug and its Possible Injurious Effects.—Many drugs, such as dilute acids, iron, arsenic, salicylates, iodids, bromids, digitalis and mercury are irritating to the mucous lining of the stomach and may cause pain, nausea and vomiting. All such drugs should be well diluted or the patient should be given a glass of water following. They are given after meals usually so that they may be diluted with the stomach contents and not come in contact with its walls. Dilute acids such as hydrochloric acid and liquid preparations of iron are also destructive to the teeth. They should be given through a glass tube or a straw which may be thrown away after use—one long straw may be cut into two or three pieces and in this way serve several patients. Dilute hydrochloric acid is frequently added to a drinking glass of water and the patient is instructed to sip this during the meal, in this way approximating the normal secretion in the stomach. The mouth should receive careful attention when such drugs are given. Some doctors give bicarbonate of soda with aspirin and other preparations of the salicylates to lessen the irritation in the stomach and to prevent acidosis. To prevent the irritation due to calomel it is usually given in very small doses. For instance, one-fourth of a grain may be ordered to be given every fifteen minutes or every half-hour for six doses or until the total amount desired has been given. Sometimes patients find calomel gives less discomfort and nausea if given with bicarbonate of soda. This alkali was at one time given to prevent the formation of bichlorid of mercury by the union of calomel with hydrochloric acid. It is now known that bichlorid of mercury is not formed in the stomach in this way.

How to Make the Medication Acceptable to a Patient.—There are a few drugs such as the bitter stomachics, quinin, gentian and nux vomica, etc., which owe their stimulating effect on the appetite entirely to their bitter taste. These drugs are, therefore, given undiluted with no attempt to disguise the taste. In all other cases the taste should be made as unobjectionable as possible. The drug should be diluted sufficiently to make it palatable and water should be given immediately afterward from a clean glass. The water should be cold. Ice may be held in the mouth before and after the medication in order to numb the taste buds. It is unwise to try to disguise the taste with milk or other food. This is likely to cause a distaste for food which is always to be avoided, especially with the very sick.

While a nurse's manner should not be hurried when giving a dose of medicine to a patient, there should be no unnecessary delay. Hesitation on the part of the patient makes the medicine harder to take and more distasteful.

Patients receiving iodids are apt to have a constant disagreeable taste in the mouth because iodin in eliminated in the saliva. A mouth-wash with an agreeable flavor should be used frequently.

Castor oil, to most people, has a very disagreeable taste. There are various ways in which the taste may be disguised. It may be taken with whisky, brandy or peppermint or it may be emulsified by adding lemon juice and bicarbonate of soda and taken while effervescing. These are all drugs, however, which can only be used with a doctor's order. The following method is simple, satisfactory and always permissible:

The medicine glass is first rinsed with lemon juice. About a teaspoonful of lemon juice is poured in the glass, then the oil and on top of that more lemon juice. To this one or two small pieces of ice are added. The glass is then placed in a small saucer and surrounded with small pieces of chipped ice. The taste of the oil is much less disagreeable when cold. The patient is allowed to hold the ice in his mouth before and after taking the oil. The cold numbs the nerve endings in the mouth so that the sense of taste is lost. Orange juice, vichy, seltzer or an olive will often prevent the feeling of nausea which sometimes follows the taking of a dose of castor oil.

When it is difficult for patients to swallow pills or tablets, etc., they should be broken up, powdered and dissolved. Powders which will not dissolve readily or which have a disagreeable taste may often be given in capsules. Compound licorice powder will not dissolve readily in water. It should be mixed into a paste with a small amount of water. Sufficient water should be added to enable the patient to swallow it. Adding too much water is apt to cause nausea. It should be followed by a drink of water.

7. By Rectum.—Drugs are most frequently introduced into the rectum for a direct local effect. The purpose may be to relieve distention, diarrhea, constipation or pain and to apply a remedial application to a diseased mucous lining. Drugs are also given by rectum in the form of a nutritive, stimulating or sedative enema, to produce a systemic effect. Paraldehyde is frequently given by rectum, as a general sedative, because of its disagreeable taste and odor. Drugs may also be given by rectum to produce a remote local effect, as for instance, when potassium acetate is given in an enteroclysis or proctoclysis to stimulate the kidneys and increase the flow of urine.

Drugs are introduced into the rectum in the form of suppositories, enemata, enteroclyses or proctoclyses. The enema, enteroclysis and proctoclysis are discussed in Chapters XI and XXXI.

Rectal suppositories may consist of concentrated food, soap, glycerin or plain or medicated cocoa-butter. They are prepared in the shape of a cone. They retain this shape at a normal or room temperature but when introduced into the rectum are dissolved by the heat of the body. Drugs contained in them are then set free.

Varieties of Suppositories Used.

(a) Evacuant.—Soap and glycerin suppositories are used to cause the expulsion of feces. They are particularly valuable when the feces are in the lower bowel or rectum, but cannot be expelled because the tight or sensitive anal sphincter will not relax. The irritation caused by the presence of the suppository stimulates the rectum to expel it. Glycerin suppositories for adult use are larger than those used for infants and young children. Long, thin suppositories are used for infants. Soap suppositories may be purchased ready for use, but may easily be made by taking a splinter of white soap and holding it in hot water until smooth and rounded to the required length and shape. It should be cone-shaped and may be from one to three inches long.

(b) Astringent suppositories consisting of tannic acid, belladonna, and glycerin are used in dysentery and diarrhea to contract the tissues, check bleeding, relieve pain and dry up the secretions. Bismuth suppositories are used in the same conditions. The bismuth forms a coating on the mucous lining and prevents irritation. In this way it checks diarrhea caused by the irritating contents in the intestines.

(c) Ice suppositories are sometimes used to check local bleeding or to relieve local inflammation. An ice suppository may be made in the same way as the soap suppository. It must be of a suitable shape and size, round and smooth and free from all sharp edges.

(d) Anodyne or local sedative suppositories are used for hemorrhoids, dysentery, diarrhea, rectal abscesses or in postoperative conditions in which it is necessary to limit peristalsis and keep the rectum at rest. The drugs commonly used are cocain, opium and belladonna added to cocoa-butter. Cocain relieves pain and by contracting the blood vessels relieves bleeding if present. Opium and belladonna relieve pain, check peristalsis and dry up secretions.

(e) Suppositories containing opium or veronal acetate are given for a general sedative effect when for any reason it is inadvisable to give the medication by mouth.

(f) Specific Suppositories. In malaria large doses of quinin given as a specific frequently cause severe gastric disturbances on account of the irritating effect of the quinin on the lining of the stomach. To prevent this quinin may be given in the form of a suppository.

Method of Procedure.—A suppository should be well lubricated with a small amount of petrolatum or other lubricant before insertion. It should be carried to the bedside in a gauze wipe or a small piece of gauze. When inserting the suppository a nurse wears a glove and inserts the suppository as far as the finger will reach. Pressure is then applied over the rectum for a short time until all desire to expel the suppository has passed. A patient should never be permitted to insert a suppository.

Suppositories should always be kept in a cool place to keep them from melting. It is necessary to keep glycerin suppositories on ice.

Vaginal and Urethral suppositories are also used.

Vaginal suppositories are used as a means of applying local remedies to the cervix or walls of the vagina. A vaginal suppository is inserted in the same manner as a rectal suppository. The patient should lie flat on her back with her knees flexed. Vaginal suppositories are larger than rectal suppositories.

Urethral suppositories are much smaller and are shaped like a fine pencil. They are well lubricated and gently inserted and pushed forward until the entire length has been introduced.

8. **By Inunction.**—Oily or fatty preparations are rubbed into the skin either for a local or systemic effect. The remedies most commonly applied in this way for a systemic effect are cod-liver oil, olive oil or cocoa-butter for malnutrition or delicate infants, and mercurial ointment in syphilitic conditions.

Method of Application.—The amount of absorption and the beneficial effects derived from the inunction will depend upon the condition of the skin and circulation, the extent of surface to which the application is made and the thoroughness with which the ointment is rubbed in.

Method of Applying Cod-Liver Oil, Olive Oil or Cocoa-butter.—The application may be made to the chest, abdomen, back, limbs or to the whole body.

The skin should be washed with hot water and soap to remove all fatty substances as these prevent absorption. It should then be dried. The oil should be warmed and rubbed in with the palm of the hand until absorbed. A circular movement is used in rubbing.

Method of Applying Mercurial Ointment.—As mercurial ointment is irritating and poisonous a limited amount is used and it is applied to a small surface only. The doctor orders the amount of ointment to be applied. To aid absorption the ointment is rubbed into regions where the skin is thin. These regions are the axilla, front of the elbow, inner surface of the thigh, and the groin. To prevent irritation the ointment is never applied to the same area on successive days. The above areas may be used in rotation on successive days. This is called a "course" of applications. The treatment is then omitted for a day and the parts are washed to remove any of the ointment which may remain in the pores of the skin. The "course" is then begun again in the same order. The area to which the application has been made should be indicated on the chart each day.

The preparation of the skin is the same as in applying cod-liver oil.

A nurse should always wear a glove in applying mercurial ointment. The bare hand should never be used on account of the danger of absorbing the poisonous drug. The amount of ointment usually prescribed is from one-half to one dram. A little at a time should be applied and thoroughly rubbed in until absorbed.

CHAPTER XXVIII

NURSING IN THE PREVENTION AND CURE OF SPECIAL MEDICAL DISEASES

The importance of expert nursing care in all medical diseases has already been noted. There are certain classes of disease where the patient's life often depends more upon the nursing care than upon any other factor. In the limited scope of this book only a few diseases in which the nursing care is one of the greatest, if not the most important, factor in the patient's recovery, can be discussed.

General Principles to be Considered.—*Prevention.*—The importance of the early recognition of symptoms and the prompt treatment of the following insidious diseases which are apt to creep upon the patient unawares or to seem of little significance have already been emphasized in the chapter on the observation of symptoms. Too much emphasis cannot be placed upon this important phase of prevention.

Treatment.—Before discussing the specific treatment of any disease, it will be well to remind ourselves of the four important factors in the treatment of every disease, upon which recovery mainly depends. These principles were laid down in the first chapter of this text on nursing, for they form the basis and keynote and are the very substance and essence of all good nursing. They are particularly important when a disease is apt to be prolonged.

1. Sufficient physical and mental rest and sleep must be obtained if possible. In accordance with his needs, sufficient mental and physical exercise, active or passive, should be provided.
2. Annoying symptoms and discomforts which sap the patient's vitality and often obscure the true state of the system must be relieved.
3. Vital resistance by proper feeding must be maintained.
4. Elimination of effete materials by the kidneys, bowels, and skin must be maintained.

These principles are particularly applicable to the care of medical diseases and are to be applied in the treatment of the body as a whole, and also in the treatment of disease of any organ. The symptoms of any disease are merely the manifestations of Nature's forces at work in the application of these principles. For instance, *pain* is Nature's insistent demand (one which we are forced to heed) for absolute rest of a diseased part so that the cells may devote their entire attention to repair; difficult breathing in heart disease forces one to rest; vomiting, diarrhea and coughing are means of eliminating substances which not only irritate but interfere with function; an elevated temperature increases the vital resistance and aids the body to combat bacteria; when a part is diseased, vital resistance by proper feeding is maintained by sending an increased and free supply of blood to it.

This effort to meet the normal demands of the body means a tremendous loss of vital energy, and if continued will wear the patient out. The treatment of disease must therefore be to remove the cause of the trouble and relieve the symptoms when they are so intense or so prolonged as to tax the patient's strength.

Only those diseases most commonly met with and which require special nursing care will be discussed here, but the general principles laid down may be applied to similar conditions having features in common.

Nursing Care in Diseases of the Circulatory System

The nursing care is the most important factor in the treatment of diseases of the heart and blood vessels. The doctor carefully examines the heart with his stethoscope, etc., determines the lesions present, makes a very careful diagnosis, and then, as it were, forgets it. That is, in the treatment he is guided not by the lesion found, but by the degree to which the normal reserve force of the heart has been exhausted. This is indicated by symptoms of distress, indicating impaired function in various organs due to deficient circulation. The proper functioning of every organ in the body, including that of the heart itself, depends upon the ability of the heart and blood vessels to maintain an efficient circulation. The heart, like other organs in the body, possesses a remarkable degree of reserve force which it may call upon. As long as the demands of the body are within the limits of this reserve force, even though there be serious lesions in the heart or blood vessels, no symptoms of distress will appear. When the demands are too great and the heart fails to supply an efficient circulation, the various organs are unable to function properly and symptoms of distress occur. The chief duties of the nurse are to so regulate these demands that the heart's reserve force will never be exhausted but will be conserved in every way possible until fully restored. In this way the patient may be restored to a normal, useful, happy life.

To understand how to perform these duties properly we must remember the *factors which control the work* of the heart. These are the *cardiac muscle*, the *accelerator nerve*, the *inhibitory* or *vagus nerve* and the *resistance offered by the peripheral blood vessels.* Whatever increases the demands on the heart muscle tends to exhaust the reserve force; whatever stimulates the accelerator nerve makes the heart beat faster and robs the normal resting period and exhausts the heart muscle; whatever stimulates the inhibitory nerve in a rapid, irritable or failing heart slows the rate and lengthens its resting period; whatever abnormally contracts the blood vessels or raises the blood-pressure increases the demands on the heart and exhausts its reserve force.

If we understand the diseases of the heart, as explained in the lectures on medical diseases, if we have examined diseased hearts and have a picture in our minds of the conditions under which the heart may be struggling we will be more impressed with the need for saving the heart in every way possible. For instance, if we realize that in pericarditis every beat of the heart causes severe pain and that every extra demand upon the heart and every unnecessary beat not only mean increased pain but an aggravation and spreading of the inflammation, we will try to lessen the number of beats and rest the heart. If in pericarditis fluid collects in the pericardial sac, the pain may be relieved but the distress and danger and the need for careful nursing will be still greater because the pressure on the heart interferes with its action even more than the pain. The heart may fail altogether to beat against the increasing pressure. Again, in myocarditis, if we remember that the work of the heart depends upon the myocardium and that one of the results of inflammation is always partial or complete loss of function we will realize that just as few demands as possible should be made upon the heart. The same is true in endocarditis, or in either stenosis or regurgitation at any of the heart valves. The heart will dilate, its muscle will increase in thickness and strength to its utmost capacity in order to overcome the difficulty and meet the demands of the body. This is the heart's reserve force. When pushed beyond this limit, its strength is overdrawn and the heart fails.

The early **symptoms** which indicate a failing heart and which demand treatment are breathlessness, increased pulse rate, distress, discomfort or pain about the region of the heart caused by some effort normally performed with comfort. Later symptoms are dyspnea, orthopnea, cyanosis, cardiac cough, cardiac asthma or fluid in the pleural sac due to deficient circulation in the lungs; scanty urine with albumin and casts due to poor circulation in the kidneys, jaundice and ascites due to congestion in the liver; edema of the extremities and a rapid or irregular pulse.

The Nursing Care.—In most diseases of the heart we must remember that we are dealing with an infection, or the result of an infection in a vital organ which cannot be treated by surgical measures nor greatly relieved by local applications or drugs. The treatment must consist chiefly in building up the patient's resistance to the infection by improving his general health.

Rest is the first essential. The degree of rest necessary varies with the stage of the infectious process and the amount of reserve force (indicated by the symptoms) which the patient's heart possesses. As long as fever, which is due to the infection, is present, rest in bed is necessary. When the limit of the heart's reserve has been reached and even slight exertion causes dyspnea, then *absolute rest* of mind and body is essential until the reserve is restored. This means freedom from all physical, mental or nervous causes of strain or whatever throws additional work upon the heart. The patient must remain in bed.

His *position* should be recumbent, if possible, to lessen the work of the heart but if breathing is difficult then use that position which affords the greatest comfort with the least strain. The mattress should give firm support. When propped up the support must be firm, the head supported, the arms supported, not resting on chest or abdomen. He must not be allowed to slip down in bed. The pillows must not be allowed to push his shoulders forward making his back rounded and his chest hollow. His chest should be thrown forward and not allowed to cave in, for the lungs must have free room for expansion. A Gatch bed is most desirable for such patients. Nothing should be allowed to interfere with breathing, such as the head unsupported and falling forward on the chest, or the weight of an ice-bag, poultices or bedclothes. When the patient leans forward there should be a proper rest to lean upon. Sometimes the patient is more comfortable sitting up in a chair and leaning forward. This provides better circulation in the lungs and brain, although the extremities may suffer. For dropsy the patient must be in bed with the extremities elevated; massage and a firm bandage may improve the circulation.

In giving treatments, in the use of the bedpan, and in feeding the patient all exertion and strain should be avoided. When an ice-bag is applied to relieve pain or stimulate the heart muscle, its weight should always be supported. (See Chapter XVI.) All causes of mental or nervous strain should be avoided. The patient should be free from worry, excitement, irritation or anger. He must be saved even from thinking for himself, as far as possible, for it often exhausts a sick person more to have to think and decide for himself than to act for himself.

Sleep is essential, for the heart cannot regain strength without sleep. No treatment will benefit if the patient is worried or troubled by unpleasant dreams or disturbed sleep. *Sedatives* are frequently necessary.

Comfort is essential and every known art should be used to insure it. In severe cases visitors should be excluded. The breathless patient should not be forced to talk or even to listen to conversation.

The Room.—The surroundings and the whole atmosphere created by the place, the doctors and nurses greatly influence the patient's health. In an illness apt to be prolonged, the mental attitude has a marked effect on the progress. The room should be bright, cheerful and quiet, the surroundings congenial, free from disorder or confusion. *Fresh air* is essential as the patient should get all the oxygen possible with the least amount of effort. The proper *temperature* and *humidity* will lessen the difficulty in breathing and add greatly to the patient's comfort. When the temperature and humidity of the air are increased the discomfort of the patient and difficulty in breathing are most distressing.

The *care of the skin* is very important, as the impaired circulation and nutrition with a prolonged illness make bedsores a real danger. Chafing and irritation are to be particularly avoided with edema. Daily cleansing baths and frequent massage are given to refresh the patient, stimulate the circulation, and keep the skin in good condition.

The *diet* has a very marked bearing on the patient's comfort and recovery. The circulation is impaired in the digestive tract so that the appetite and digestion may be poor. Fermentation and putrefaction with dilatation of the stomach and distention may follow, and this greatly interferes with the breathing and also with the action of the heart. To prevent this the *mouth should be kept clean* and the food carefully regulated. It should be tempting, given in small amounts at fairly frequent intervals. Overeating or drinking should be avoided. The patient should be instructed to chew the food thoroughly and to take small mouthfuls, especially when troubled with difficult breathing. Do not force food which causes distaste or discomfort. Food should never be forced because, if the patient cannot be tempted, the digestion is at fault and we must guard against indigestion. Chewing food is also sometimes too great an effort for the patient. Give food which the patient likes if it does not disagree. Avoid articles which cause distention such as beans or cabbage, etc. With a failing heart the diet should be light and dry.

Fluids are restricted because they increase the edema and add to the burden of the heart. The amount given should be measured and charted. Food should be given frequently enough to avoid faintness. To avoid faintness or sleeplessness during the night, due to hunger, a dry biscuit and a small glass of milk may be given before bedtime and again early in the morning.

Regulation of the bowels is also important in order to avoid distention and auto-intoxication which is a predisposing factor in arteriosclerosis and hypertension. The stools should be examined for evidence of fermentation or putrefaction. Free purging is frequently ordered to relieve edema; the patient should be watched closely as this may be exhausting.

The *urine* may be scanty on account of the impaired kidneys. It should be carefully measured and examined. The amount should be compared with the intake of fluids to determine the ability of the kidneys to eliminate water.

Therapeutic Baths.—Baths much above or below the body temperature should never be given without a doctor's order. They have a marked effect on the peripheral circulation and therefore upon the heart. Warm baths act as a sedative and sometimes give relief. The Nauheim baths or sea bathing are sometimes ordered to tone up the whole system.

Exercise.—When the reserve force is restored, the patient is gradually allowed more exercise. A certain amount of exercise is good for the heart, in order to train and strengthen the muscle, providing one keeps within the limits. The doctor prescribes the amount of exercise and the nurse watches the effect on the patient. If no symptoms of distress appear the exercise is beneficial. Graduated exercises are usually prescribed while in the hospital. Exercise which gives pleasure without discomfort is best as the mental side is important. When fit, exercise in the open air is best. It is important to remember that exercise enjoyed with comfort one day may be quite impossible another day or under different conditions. The weather, climate and the patient's condition all have an important bearing. For instance, exercise possible when the atmosphere is high and dry may be quite disastrous when the atmosphere is low and humid. Again exercise possible at one time may be quite dangerous where the heart is embarrassed by worry, want of sleep or by gastric disturbances, etc. The patient is instructed regarding those conditions which embarrass the heart and is encouraged to feel that the lesion in his heart need not prevent him from living a useful, happy life providing he lives within the limit of his reserve strength. He needs no one to tell him when this is the case, as his own sensations are the best guide.

Drugs.—*Digitalis* is commonly used in failure of the heart when the persistent, rapid beat threatens to exhaust the heart. Digitalis slows the heart-beat, rests the heart, and strengthens the muscle. It also acts as a diuretic so gives relief in dropsy. When digitalis is given watch for a slow pulse, nausea or diarrhea as these symptoms indicate poisoning.

Nitrites (amyl nitrite or nitroglycerin) are sometimes given when contracted blood vessels and a high blood-pressure increase the resistance and strain on the heart. They dilate the blood vessels and lower the pressure. When amyl nitrite is given watch the patient for a flushed face, throbbing in the head followed by faintness and giddiness; these indicate that the drug should be stopped.

Bromids, *veronal* and when necessary *chloral* or *opium* may be prescribed for sleeplessness, anxiety or worry, etc.

Treatments.—*Aspiration* of serous cavities—the abdominal, the pleural or pericardial—may be necessary for the relief of dropsy. *Dry cupping* may be ordered for the relief of pulmonary congestion, and *venesection* for the relief of venous congestion with cyanosis.

NURSING CARE IN DISEASES OF THE ARTERIES

Arteriosclerosis may be (1) either the effect or the cause of high blood-pressure; (2) the effect of poisons in the blood, as in syphilis, typhoid, Bright's disease, diabetes, gout, or constipation, etc., or (3) the effect of senile decay—the blood-pressure is normally increased with old age. Strain, mental, physical or nervous, increases the tendency to arteriosclerosis or "hardening of the arteries." In this disease the lumen of the arteries becomes occluded, many capillaries may disappear altogether, and the heart becomes enlarged with degeneration of its muscular tissue. The result is diminished blood supply and therefore, impaired function in the various organs affected. If the *coronary arteries* are affected, every effort of the poorly nourished heart muscle may be accompanied with distress, pain and breathlessness. Angina pectoris may result. If the *renal arteries* are affected, degeneration with Bright's disease follows; if the *arteries of the brain,* degeneration, softening and possible rupture and hemorrhage from the weakened blood vessels resulting in apoplexy —this is the great danger in arteriosclerosis. The results of arteriosclerosis in the old are very familiar. This condition accounts for the ease with which they become either physically or mentally fatigued; the pains and cramps in the muscles of the legs with exercise or lying in bed; cold or numbness or pain in the extremities; sensitiveness to cold, loss of appetite and impaired digestion; the thin "tissue paper" skin and the small amount of oozing which occurs when their tissues are cut. Diminished blood supply in the brain results in loss of memory, fatigue on attempting to concentrate, irritability, uncertain temper and delusions. Inability of the circulation to adjust itself quickly causes giddiness on standing up quickly or with sudden exertion. Old people are apt to doze frequently when sitting up on a chair, due to lack of blood in the brain, but may sleep poorly when lying down.

The Nursing Care and Treatment aim to avoid, as far as possible, conditions which aggravate the disease and cause contraction of the arteries or increased blood-pressure. All excesses in exercise, food, drink, and habits should be avoided. The functions of the skin, the kidneys and bowels should be carefully regulated by warm baths, drinking water freely, and the avoidance of constipation. Exposure to cold contracts the blood vessels and should be avoided by regulation of the clothing, by warmth to the extremities, and hot drinks to relax the blood vessels. Old people in particular stand exposure to cold badly—cold air, baths, or being deprived of their customary clothing and surroundings. When not allowed to wear flannel underwear in bed they should have extra blankets or a hot-water bag and frequent massage to the limbs to restore the circulation and prevent cold and cramps, etc. When the arteries of the brain are affected, the danger of apoplexy must always be remembered. All causes of worry, excitement, anger or irritation must be avoided, as they greatly increase the supply of blood and the blood-pressure in the brain, shown by the flushed face and prominent blood vessels. Slight, petty causes of irritation particularly upset the patient.

The same is true in angina pectoris. Particular care should be taken to observe moderation in food, drink and exercise and to avoid constipation or foods which cause distention. Sudden death frequently occurs from "acute indigestion" combined with some unusual exertion and strain on the heart. Nitroglycerin or amyl nitrite is usually ordered to dilate the blood vessels, and bromids or morphin to relieve the pain and to quiet and relieve the patient from the fear of impending death.

Aneurysm is due to a diseased condition of the arteries causing them to bulge where the wall is thin and is accompanied by symptoms of pressure on neighboring structures—the lungs, bronchus, trachea, esophagus (with difficulty in swallowing), veins, ribs, sternum or spine, etc. Pressure, constant pulsation, and corrosion of bone cause very severe, persistent boring pain. The danger in aneurysm is sudden death from rupture of the diseased artery.

The **Nursing Care** is to avoid all conditions which will tend to raise the blood-pressure or increase the force of the heart-beat.

THE NURSING CARE IN ANEMIA

Anemia means the loss or destruction of red blood cells, of hemoglobin (the oxygen carriers), or of both. Every cell in the body suffers and smothers for the want of oxygen, so necessary for all the processes of metabolism. The result is muscular weakness, breathlessness and impaired function of every tissue and organ in the body. In pernicious anemia the marked cell destruction is shown in the greatly reduced red cell count and hemoglobin, the presence in the blood of abnormal red blood cells, the peculiar lemon color of the skin, fever, and increased urobilin and iron in the stools and urine. The patient becomes very weak and suffers from dyspnea, faintness, dizziness, palpitation and dyspepsia.

The effect on the *digestive system* is seen in the lessened hydrochloric acid in the stomach, loss of appetite, vomiting, diarrhea or constipation, abdominal pains, discomfort and distention. The patient suffers periodically from soreness or rawness, sometimes with ulcers, of the tongue and mouth which may extend to the throat. This causes pain in chewing and eating, especially hot, acid, or spiced food.

The effect on the *nervous system* may be degeneration of the brain, cord and nerves with defects in sight or hearing, and partial loss of sensation, with numbness and tingling in the hands and feet.

The **Nursing Care** consists in providing absolute rest and freedom from all conditions, mental or physical, which increase the strain on the heart and other organs. Fresh air, sunlight, quiet but cheerful surroundings, freedom from care or worry, and plenty of sleep are essential. Every atom of strength should be conserved. Anemic patients feel the cold and should be protected not only for comfort, but to save energy otherwise used in keeping warm. Proper bathing, the care of the mouth, the regulation of the bowels and of the diet are extremely important.

The *diet* is of special importance. It has been found that patients with pernicious anemia show a marked improvement when given a special diet which is rich in nucleoprotein, and other proteins, very low in fat, and which contains carbohydrate, chiefly in the form of fresh vegetables and fruit. Liver is rich in nucleoprotein and is essential in the diet. It is thought that liver plays a fundamental rôle in the production and storage of the parent substances used in the manufacture of hemoglobin and red cells which accounts for the marked improvement in this respect. Foods rich in iron, such as eggs, fish, meats, spinach and other green vegetables are also of great value, but are said to be of secondary importance.

The daily diet usually consists of 120 to 240 grams of liver, kidneys, sweetbreads, or brains; 120 to 240 grams of lean, red muscle meat; 300 grams or more of vegetables containing 1 to 10 per cent. of carbohydrate; 300 to 400 grams of (preferably) fresh fruit; 70 grams or less of fat—fats are restricted. Sweets, cereals, breads, and other starch foods are used as desired to bring the total calories up to about 2500 for the average person, but are used sparingly and not to the exclusion of the above essential foods. In each case the needs of the individual patient—his condition, likes, dislikes, and special desires—must be considered. In the selection, preparation, and serving of food every effort must be made to appeal to the patient, to improve his appetite, and to see that he is receiving the desired kind and amount of food. The continuous use, the large amount and bulk of liver in the diet, frequently makes it a difficult one for the patient. Several small meals are sometimes better tolerated than the usual three meals.

Every effort should be made to improve the appetite and to build up the strength by a nutritious diet. It should be plain, easily assimilated and contain foods rich in iron, such as eggs, spinach, fish and meats, etc. Extreme care should be taken during the periodic attacks of soreness and rawness of the mouth and impaired digestion; good digestion alternates with periods of bad.

The *drugs* used in anemia are iron and arsenic. Iron is used to aid the formation of hemoglobin. When iron is given watch for an upset stomach and constipation. Arsenic is given to stimulate the bone marrow in the formation of red blood cells. When arsenic is given note if the eyes become puffy or if the patient complains of stomach trouble or a cold in the head. These symptoms indicate poisoning.

Transfusions may be given to increase the volume of the blood, the number of red cells and hemoglobin, to increase the patient's resistance, and to stimulate the bone marrow. These treatments do not cure the disease but may prolong life for a number of years. (See "Transfusion," Chapter XXXII.)

NURSING CARE IN DISEASES OF THE KIDNEYS

Acute Nephritis, Chronic Nephritis, Uremia

The **Nursing Care and Treatment** consist in removing the cause, if known, avoiding conditions which predispose to or aggravate the disease, finding the amount of work the diseased kidneys are capable of performing, regulating the diet, the habits and general hygienic care of the patient so as to rest and restore the kidneys, and treating the symptoms as they arise. The nursing care is the most important factor. This includes the care of the skin, strict attention to the diet, accuracy and care in the collection of urine specimens, intelligence in giving the treatments ordered, and care in avoiding anything which would increase the work of the kidneys.

Nephritis means *inflammation* of the kidneys. *Complete rest* is the first essential in the treatment of inflammation. This can only be provided by lessening the work of the diseased organ. The work can only be lessened by regulation of the diet, by lessening the wastes from tissue metabolism, by preventing infections, avoiding the use of irritating drugs, and by stimulating elimination through the skin and intestines.

The Work of the Kidneys.—All the food which enters the body—protein, carbohydrates, fats, water and mineral salts—is finally burned and the ashes which remain must be eliminated from the body. The work of the kidneys is to eliminate practically all the *ashes resulting from the metabolism of protein, the acid wastes of metabolism, about four-fifths of the water, most of the salts,* sufficient to maintain the optimum concentration of salts in the body fluids and tissues, and a small amount of *carbon dioxid.* In addition, it must eliminate *drugs* taken into the body, *germs* which enter and multiply, and other *poisonous products of disease* from other parts of the body. In this way the kidneys may become infected, sometimes from a focal infection elsewhere in the body, such as teeth or tonsils, and may in turn become a focus of infection. The lungs, intestines, liver and skin also eliminate water, carbon dioxid, and small amounts of salt. In diseases of the kidneys, Nature saves the diseased organ by increasing the elimination of wastes through these pathways.

The Work Performed by a Diseased Kidney.—A diseased kidney cannot perform its work properly. Sometimes it cannot eliminate the ashes of protein—urea, uric acid, creatinin, hippuric acid, ammonia, etc.; sometimes it cannot eliminate the acid wastes of metabolism; sometimes it cannot eliminate salts, and sometimes it cannot even eliminate water.

Symptoms to be Observed.—The products of protein metabolism from which urea, etc., are made are extremely poisonous and if not eliminated may give rise to symptoms of *suppression* and *uremia,* the symptoms of which are drowsiness, headache, disturbance of vision, nausea, vomiting or diarrhea.

Convulsions, coma, and death may follow. If acids are not eliminated, acids will increase in the blood; the normal alkalinity will be lessened and dyspnea and other toxic symptoms of *acidosis* will appear. If salts are not eliminated, water will also be retained in order to dilute them and maintain the normal concentration of 0.6 per cent. of salt in the tissues. Any marked change from this is incompatible with life; the result is edema. Salts, particularly sodium chlorid, are very irritating to the inflamed kidney. If *water* is not eliminated the result is *edema* and *anuria*. Edema is usually seen first in the loose tissue of the eyelids and beneath the eyes. With edema will be an increase in weight and an increase in blood pressure. The weight in nephritis is always important. A loss in weight is usually coincident with a lessened edema, lowered blood-pressure, and increase in volume of urine.

A *high blood-pressure, arteriosclerosis* and a *hypertrophied heart* are almost always present, particularly in chronic nephritis. Symptoms of these diseases will then occur. (See diseases of the circulatory system.)

In nursing, it is extremely important to know what to look for, to observe and report the first symptoms, and thus prevent further development.

Examination of the Urine.—Twenty-four-hour specimens are always collected and sent for examination. Extreme care should be taken in the collection of these specimens as the examination of the urine is the chief means of finding out how much work the kidneys are capable of doing and of determining to what extent the patient must be restricted in diet and normal habits of life. A nurse should also take an intelligent interest in the reports made, so that she will understand the diet and treatments ordered by the doctor and know how best to care for her patient.

The specimens will be sent to the laboratory to be examined for the specific gravity and the presence of the *abnormal constituents,* albumin, epithelial cells, leucocytes and red blood cells, casts (hyaline, granular, epithelial, or waxy casts), blood and pus. The presence of casts indicates alteration, degeneration or destruction of the kidneys due to circulatory disturbance, toxic or inflammatory processes. Their presence in the order mentioned indicates the severity of the disease.

The *Esbach* test is frequently used. It is a quantitative test used to indicate the total amount of albumin excreted in twenty-four hours.

In acute nephritis there may be partial or complete suppression. The urine will be highly colored, cloudy, of high specific gravity and will contain a large amount of albumin, casts, and frequently blood and pus.

In chronic interstitial nephritis the urine is pale, clear, of low specific gravity, with only a faint trace of albumin, and greatly increased in amount, so that the patient must rise to void during the night. Frequently more is voided at night than during the day. The amount is increased because a large amount of water is voided to dilute and render the waste products less irritating.

The *functional efficiency* of both kidneys together or each kidney separately may be tested by examining the normal constituents eliminated. As the diseased kidneys cannot function properly the normal constituents decrease as the abnormal increase. They may be tested together (1) by measuring the "intake" of protein in the diet, the total "output" of nitrogen (protein waste), and the amount of nitrogen in the blood. Specimens of urine and blood will then be sent to the laboratory to be examined for "total nitrogen" or "total urea"; (2) by measuring the "total chlorids" of the urine; (3) by measuring the intake of fluids and the output of urine; (4) by the phenolsulphonephthalein test. The normal output of nitrogen in twenty-four hours on the usual diet is about 15 grams; the normal output of urea, about 30 grams; the normal output of chlorid, from 10 to 15 grams. The normal "blood nitrogen" is 25 to 30 mgm. per 100 c.c. of blood; the "blood urea" is from 11 to 15 mgm. per 100 c.c. of blood. In nephritis, the blood urea or nitrogen may be greatly increased and the output in the urine greatly decreased.

The Phenolsulphonephthalein Test.—*Principle.*—Phenolsulphonephthalein is a colorless, harmless dye which under normal conditions when injected subcutaneously is very rapidly excreted by the kidneys. The amount present in the urine voided may be determined by comparison in the colorimeter with a standard solution. When the kidneys are normal the dye usually begins to appear in the urine in from five to ten minutes, and the total excretion at the end of two hours is from 50 to 85 per cent. In elderly people confined to bed it may be only from 40 to 50 per cent. In nephritis or with a failing heart only from 5 to 10 per cent. may be excreted.

Technique.—"The patient drinks a glass of water and about half an hour later the bladder is emptied, either spontaneously or by catheter. Exactly 1 c.c. of the solution from an ampule is then injected subcutaneously into some part of the trunk free from edema, preferably the lumbar region, using for the purpose an accurately graduated syringe. At the end of two hours from the time of injection the patient empties the bladder again or is catheterized and the urine is collected. In some cases a catheter is placed in position when the injection is given and the urine as it trickles out is collected in a receptacle containing a few drops of 10 per cent. sodium hydrate solution. The time of the first development of a pink coloration of the fluid in the receptacle is noted, as this indicates the period elapsing before the first elimination of the dye." Sometimes the dye is given intramuscularly or intravenously. Sometimes two specimens are collected. Ten minutes is allowed for the beginning of excretion. The first specimen is collected one hour from this and the second one hour later. The first specimen should normally contain 40 to 60 per cent. of the dye, and the second 20 to 25 per cent. In acid urine the dye remains colorless so that when the specimen is collected at the end of the two hours, if the urine is normal in reaction there will be no change in color to indicate the presence of the dye. In the laboratory before making the test the urine is first made strongly alkaline with sodium carbonate solution, causing it to become more or less intensely red according to the amount present.

Nephritic test diets, such as the Mosenthal, are sometimes given in chronic nephritis in which the specific gravity is low. The urine is examined, particularly to learn whether the patient, on a known, carefully regulated diet, can "concentrate his urine," that is, increase the specific gravity or the solid waste products eliminated by the kidneys. The urine is also examined for total nitrogen and chlorids. The food given is salt-free; all food and fluid is weighed or measured; all food or fluid not taken is weighed or measured so that the exact amount eaten is known; no food or fluid is given except at meal time; no food or fluid is given during the night or until eight o'clock the next morning (after voiding) when the regular diet is resumed.

The patient empties the bladder at 8 A.M. and at the end of each of the following periods: 8 A.M to 10 A.M.; 10 A.M. to 12 N.; 12 N. to 2 P.M.; 2 P.M to 4 P.M.; 4 P.M. to 6 P.M.; 6 P.M. to 8 P.M.; 8 P.M. to 8 A.M. These specimens must be collected in properly labeled bottles. Any mishaps or irregularities that occur in giving the diet or collecting the specimens should be noted. The urine is examined at the intervals noted in order to gain as accurate an idea as possible of how the kidney is working. The normal kidney responds very readily to the diet given; on a high protein diet the total nitrogen in the urine will be increased and the specific gravity of the urine varies at different periods of the day, for instance, it is higher in the early morning specimen, but in advanced chronic interstitial nephritis there may be no change in the specific gravity, or in the output of nitrogen, etc., the kidneys being quite unable to eliminate the solid wastes.

The function of each kidney may be tested separately by catheterizing the ureters and examining the urine collected from each kidney. The result may show that one kidney is perfectly normal and that the albumin and casts in the urine come from one diseased kidney. In that case the treatment may be the removal of the diseased organ. Again in a tuberculous kidney part of the kidney may be diseased, causing albumin and casts to appear in the urine, but the rest of the organ may be normal and do the work of the whole kidney efficiently.

These *functional tests* are very important from the standpoint of diagnosis and treatment. For instance, in advanced chronic nephritis an examination of the urine for abnormal constituents may show only a trace of albumin and an occasional cast, and yet a test of the functional efficiency may show it to be so greatly reduced that any extra strain, such as an infection elsewhere in the body or an ether anesthesia, may bring on an acute attack, possibly uremia and death.

The value of all such tests depends upon the intelligence and accuracy with which nurses carry out instructions in relation to the diet and collection of urine specimens.

The Nursing Care and Treatment.—*Rest* in bed is essential. All unnecessary exertions are to be avoided. The patient may not even be allowed to sit up because all forms of exercise mean increased metabolism and tissue wastes to be eliminated and the ashes formed are very irritating to the kidneys. For this reason all causes of discomfort and restlessness are particularly to be avoided.

The Diet.—Rest of the kidneys is only possible through a carefully regulated diet. It is usually restricted in amount and very carefully selected. All foods which irritate or are eliminated with difficulty or whose ashes increase the work of the kidney are to be avoided. Starvation is also avoided as it results in destruction of muscles and other body tissues, the ashes of which are irritating and increase the work of the kidneys. *Protein* is restricted to an amount barely to meet the body needs. The lowest level of protein for an adult is 1 gram per kilogram of body weight. Higher amounts are given if the kidneys are excreting protein ashes well. Salt may also be restricted to either a "salt-poor" or "salt-free" diet. Salts are restricted particularly in edema. Sometimes milk alone is given because it is low in sodium chlorid. It contains sugar and fat (cream may be added) and sufficient protein to meet the body needs may be given in this way. *Fruits* contain very little salt so are freely given. *Sugar* and *fats* leave little waste for the kidney to eliminate. They increase the caloric value and prevent tissue destruction, so are usually allowed. When the patient is anemic and underweight, a high caloric diet is given. *Foods which irritate,* such as celery, onions, radishes, garlic and condiments are to be avoided. *Meat* extracts and broths are also avoided. They have little nutritive value and contain sodium chlorid, pigments, creatinin, etc., irritating to the kidneys.

Fluids.—When the kidneys are able to eliminate and the patient is not edematous, fluids are usually forced, to dilute the waste products, flush them from the system, and lessen irritation of the kidneys. Water, lemonade, orangeade, and imperial drink are given by mouth. Water is also given by rectum by means of colon irrigations or the Murphy drip. Where the patient is edematous, and in anuria, showing the kidneys to be impermeable to water, fluids are restricted and elimination through other channels is encouraged. *Thirst* which usually results may be relieved by ice or water in small amounts. The care of the mouth is very important. The amount of fluid, or the "intake," should be carefully measured and charted. The *weight* is also recorded.

Mental Nursing.—The fact that this restricted diet, especially the craving for salt and water, is apt to make the patient unhappy, irritable and depressed, must be constantly in the mind of the nurse.

Emotional disturbances interfere with rest, place an added strain on the vascular system, increase metabolism and tissue wastes. The effect of nervousness on the kidneys with increased diuresis is well known. This should be remembered and avoided. Particular caution is necessary during functional kidney tests.

The *condition of the skin* is of vital importance. We rely on the skin to save the kidneys. It must be kept warm and its circulation and functions stimulated. Rest in bed between blankets, daily cleansing baths and massage aid greatly. Chilling must be avoided. It prevents perspiration and causes increased congestion of the kidneys and other organs by driving the blood from the skin. It contracts the blood vessels and raises the blood-pressure, so is particularly harmful when the pressure is already high. Shivering is injurious. It means increased muscular activity and wastes to be eliminated. All exposure to cold air or water is to be avoided. Fresh air without exposure is desirable.

The care of the skin is also important because of the danger of bedsores. The disease is prolonged and the patient is confined to bed. He becomes pale and anemic from the constant loss of albumin and from confinement. He either loses weight and becomes emaciated or his tissues are edematous. Sometimes he is obliged to sit up constantly (condition of orthopnea) and in any case his movements are restricted. All these conditions predispose to bedsores and demand the best nursing care to prevent them.

The Body Eliminations.—To rest the kidneys, elimination through all other channels is stimulated. As stated above, the circulation and functions of the skin are stimulated. When water is allowed fluids are forced to stimulate perspiration. Hot fluids are good. Hot baths, hot packs, and drugs (diaphoretics) are used for the same purpose. Heat relaxes the arteries and lowers the blood-pressure. Sweating is stimulated, particularly when there is edema. With a good sweat it is said that one quart of water and fifteen grains or more of urea and sodium chlorid may be eliminated. When the blood-pressure is high with arteriosclerosis and a hypertrophied heart extreme care must be taken in giving hot packs because of their depressing effect on the heart and nervous system, etc.

The *bowels* are kept open and stimulated by the use of cathartics which cause watery movements, especially with edema.

Elimination by the kidneys themselves is stimulated by forced fluids, by mouth or rectum, and by local applications of counter-irritants—stupes, mustard pastes and dry cupping, etc. These relieve inflammation and congestion, pain and suppression. Hot colon irrigations not only supply fluid, but as the hot fluid circulates in the colon it is in close contact with the kidneys and is an internal application of heat. Alkaline diuretics, such as sodium citrate and potassium acetate, are given, but those which irritate, such as caffeine and diuretin, are avoided.

The Avoidance of Infection.—Infections such as colds, tonsillitis, ulcerated teeth, and all other infectious diseases should be avoided. Such infections may be the cause of acute nephritis. When the kidneys are diseased their resistance is lowered so that they are very susceptible to infection by germs as they are being eliminated.

The Relief of Symptoms.—Headache is relieved by increasing the eliminations, by local applications of heat or cold and by the administration of such drugs as phenacetin or antipyrin.

Backache and suppression are relieved by the local applications mentioned above which relieve inflammation and congestion. Massage of the lumbar region also helps.

Edema is relieved by restricting salts and fluids, and by stimulation of the elimination of wastes through all channels. Fluid from the abdominal cavity (ascites), the pleural or pericardial sacs may have to be withdrawn by aspiration.

Dyspnea may be very distressing due to an hypertrophied heart or fluid in the pericardial, pleural or abdominal cavities. The nursing care is extremely important. The patient is usually obliged to sit up constantly; the weight of the edematous limbs and accumulated fluid make moving difficult; breathing is difficult; he is usually unable to sleep, and altogether, he is apt to be extremely uncomfortable, unhappy and a burden to himself.

Shortness of breath, cyanosis, and a weak pulse are very grave symptoms in this disease.

A High Blood-Pressure.—For the treatment see diseases of the blood vessels. Special care must be taken when giving hot packs—watch for weakness, fainting and palpitation.

Anemia.—The patient becomes pale and pasty in color due to the continued loss of albumin and confinement in bed, etc. Iron and foods rich in iron are usually given. Sunlight and fresh air (without exposure) are beneficial for the anemia as well as the depressed frame of mind.

Uremia.—As uremia is due to toxemia caused by failure of the kidneys to excrete, the treatment is that given for nephritis. A lavage may be given if nausea and vomiting occur. Chloral is usually given if convulsions occur. Morphin is not given, as the respiratory center is already depressed by the toxemia, shown by the Cheyne-Stokes respirations usually present.

Urinalysis.—*Tests for Albumin.*—A nurse, at least in a private home, in taking care of a patient suffering with nephritis, or a disease in which nephritis may develop as a complication, may be required to test the urine for albumin. A nurse engaged in public health work or in visiting nursing or in a doctor's office may also be required to do simple urine tests. The following are simple tests for albumin which may be used:

1. *Heat and Acetic Acid Test.*—Fill a test tube two-thirds full of urine. Add about five drops of 2 per cent. acetic acid (enough to make the reaction acid), and boil at the top, holding the tube at the bottom and directing the flame against the upper portion of fluid. Add a few more drops of acid, then examine the tube by transmitted light against a black background for a cloud in the top portion as compared with the portion just below it. If the precipitate is flocculent, take the tube in a holder and heat the entire contents to boiling and stand the tube in a rack. When the precipitate has settled, fifteen minutes or more afterward, mark the percentage of albumin according to the estimated proportion of the column of urine occupied by the sediment. The result may be reported as

"v. f. tr." (very faint trace).
"f. tr." (faint trace).
"tr." (trace).
"m. tr." (marked trace).
"v. m. tr." (very marked trace).

2. *Coagulation of Albumin by Concentrated Nitric Acid.*—Pour about 2 c.c. (one-half dram) of nitric acid in a test tube. Then an equal volume of urine is allowed to flow in slowly so as to form a layer above the heavier acid. A white ring at the junction of the fluids indicates the presence of albumin.

These tests are based upon the fact that albumin is coagulated either by heat or strong acids.

Test for Blood.—Guaiac Test.—To about 4 c.c. of urine add 1 c.c. of glacial acetic acid and 2 c.c. of ether; shake gently; pour off the ether, and add a few drops of freshly prepared guaiac tincture and 1 c.c. of hydrogen peroxid. Never use a test tube with yellow copper oxid on its wall resulting from Fehling's or Benedict's sugar test. A blue color indicates the presence of blood.[1]

The Nursing Care in Diabetes Mellitus

Diabetes is a disturbance of metabolism due to the partial or total inability of the tissues to burn carbohydrates. This inability is indicated by the presence of sugar in the urine. As the blood normally carries only 100 to 120 mgm. of sugar to 100 c.c. of blood, or 0.1 per cent. (0.07 per cent. to 0.11 per cent.) of sugar, any excess, when not burned, overflows into the urine. Diabetes is due to no fault or disease of the tissues which utilize the sugar, but to the absence of the necessary agent which will combine with the sugar and make it available to the tissues. It is as though a match or spark were needed to ignite the sugar just as coal or wood must be ignited before they will burn in a furnace.

This agent, more or less deficient in diabetes, has now been discovered. It is called *insulin* and is the hormone of the internal secretion of the islands of Langerhans in the pancreas, which regulates carbohydrate metabolism. *Indirectly* this hormone regulates fat metabolism because it is dependent upon the combustion of carbohydrates. Insulin is therefore used in the treatment of diabetes. It does not cure but temporarily supplies the hormone which the diseased pancreas is unable to supply.

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[1] "Laboratory Technique, St. Luke's Hospital," New York.

The Nursing Care and Treatment.—"The treatment of a patient with diabetes lasts through life." The best treatment is prevention—avoiding obesity and fat producing foods. As the disease is incurable, the treatment is directed toward prolonging the life of the patient as many years as possible and providing the greatest possible degree of happiness, usefulness and comfort. The treatment varies with the individual according to his age, weight, habits of life and work, the severity of the disease, and the presence or absence of other abnormal conditions. It varies not only with each individual but may vary in the same individual from day to day, from meal to meal, and from hour to hour.

One must constantly be on guard, for even a slight error may cause a mild form of the disease to develop into a severe form.

The severity of the disease is determined by regulations in the diet (selected test meals to determine the patient's tolerance for sugar), by examinations of the urine and blood, and by the general symptoms and progress of the disease. The disease is said to be *mild* when the patient's tolerance for sugar is less than normal, but the urine can be made sugar-free by simply cutting down the total diet or by eating less carbohydrates; *moderate*, when the tolerance is still lower, but the urine can be made sugar-free by eating still less and cutting down the amount of fat, protein and carbohydrates; *severe*, when the patient cannot tolerate any carbohydrates without sugar appearing in the urine; sugar may appear even on a "carbohydrate-free" diet or even in fasting or starvation. "The whole aim of diabetic treatment, both formerly and now, is to protect the patient by promoting by every means in our power the combustion of carbohydrates."

Responsibility of the Nurse.—While the doctor, and the doctor only, must prescribe the treatment, the successful carrying out of this treatment, and the life of the patient will depend upon the constant, intelligent care of the nurse and the coöperation of the patient. "The patient is at school to learn how to save his life." As the disease lasts throughout his whole lifetime he must be *taught how to care for himself*. The hospital becomes a school and either the doctor or nurse must teach him how to calculate and prepare his diet, how to examine urine, how to administer insulin, what symptoms to watch for, what to avoid, and what to do should he become sick when at home.

Nursing in Relation to the Diet.—The regulation, preparation and serving of the diet, together with personal hygiene, are the great and all-important factors. As stated previously, the doctor prescribes the diet but the successful administration of the diet depends upon the nurse. The nurse is there to see that, within the limits prescribed, the best selection is made; that the restrictions and limitations cause as little distress as possible; that variety and the tastes of the patient are considered as far as possible; that the food is properly prepared in the most digestible and acceptable form—for instance, while fat may be prescribed, foods fried in fat should never be given. She is there to avoid errors, by weighing, checking, and recording; to see that the food is promptly and attractively served; that the patient eats slowly and chews the food thoroughly; to watch the effect of the diet, and to weigh and record food not eaten, with a statement of the patient's reasons.

In order to get the best results, to avoid errors, to be able to gain the coöperation of the patient and to teach him how to plan and prepare his diet, the nurse must understand the following principles, which guide the doctor in regulating the diet:

The *aim* is to make the urine sugar-free, to increase carbohydrate tolerance, to prevent progressive loss of weight (except in obesity and overweight), and to do so without the appearance of the dreaded acid intoxication.

To Make the Urine Sugar-free and Increase Carbohydrate Tolerance.—The body of a normal person has a limit to his ability to use glucose and tolerates it up to a certain point; beyond that it overflows into the urine. In diabetes this limit or tolerance for sugar and starches is more or less reduced according to the severity of the disease. It is most important to find out just what this tolerance is, that is, how much sugar or starches may be given without sugar appearing in the urine. Each day the urine remains sugar-free increases the tolerance, whereas, if the patient is untreated, the tolerance is lowered.

Sugar in the urine may be due not only to carbohydrates given in the diet, but also to those stored in the body, as in the muscles and liver. Sugar may also be formed from protein in the diet or from that of the body tissues. Again, sugar in the urine may be due to overeating irrespective of the kind of diet: this so overworks, hampers and clogs the body that its power to assimilate carbohydrate is lessened. The urine may be made sugar-free and the tolerance for carbohydrate may be increased by resting the pancreas, that is, by resting the function of assimilation. This may be accomplished by restricting the total diet, or by cutting down the carbohydrate and protein, or by complete fasting.

Danger of Acidosis.—But the sudden reduction of carbohydrate and protein, or an increase of fat with a low or fasting carbohydrate diet, may, however, lead to very serious results, that is, to acidosis and coma. For the body simply must have fuel. If it cannot utilize carbohydrate, it will use fat as the next best fuel. But without carbohydrate, fats cannot be completely burned, for just as kindling is necessary to burn a log of hard-wood, so "fats must be burned in the flame of carbohydrates." Incomplete burning of fats results in the accumulation of fatty acids or acidosis; acidosis may cause coma, and coma, death. To prevent this, fatty acids—B-oxybutyric, diacetic, or acetone —are eliminated in the urine, their presence, therefore, indicating acidosis. Amino acids formed from protein metabolism are also contributing factors in producing acidosis.

To Regulate the Diet.—In building up a diet that the patient can tolerate, in addition to the amount of carbohydrate, protein and fat, strict attention is given to the total number of calories. If too high it will cause sugar to appear in the urine. On the other hand, the body (according to the age and weight) even when quietly at rest in bed must have sufficient calories to carry on the activities which mean life and prevent progressive loss of weight. Even when the fat allowed is high and excess protein is given sufficient to supply material for building and repair and also for the production of energy, the total calories allowed may be pitiably small because of the great restriction in carbohydrates. In the diet of the normal individual more than half of the energy comes from carbohydrates.

The aim is to provide, as far as the patient's condition will permit, a diet as well balanced and resembling as nearly as possible that of a normal person. The needs of a normal person may be seen in the following tables:

CALORIES REQUIRED DURING TWENTY-FOUR HOURS BY AN ADULT WEIGHING SEVENTY KILOGRAMS (ONE HUNDRED AND FIFTY-FOUR POUNDS) [1]

Condition.	*Calories Per Kilogram, Body Weight.*	*Calories Per Pound, Body Weight.*	*Total Calories.*
At rest	25 to 30	11 to 14	1750 to 2100
At light work	35 to 40	16 to 18	2450 to 2800
At moderate work	40 to 45	18 to 20	2800 to 3150
At hard work	45 to 60	20 to 27	3150 to 4200

"Children require far more food than adults, because of growth and increased activity."

THE CARBOHYDRATE, PROTEIN AND FAT IN THE DIET OF A MAN DOING MODERATE WORK, WEIGHT SEVENTY KILOGRAMS (ONE HUNDRED AND FIFTY-FOUR POUNDS) [2]

Food	*Quantity Grams.*	*Calories Per Gram.*	*Total Calories.*
Carbohydrate	400	4	1600
Protein	100	4	400
Fat	100	9	900

The first step in finding the sugar tolerance, after a thorough study of the patient, is to try or test certain selected diets until one is found which the patient can tolerate without sugar appearing in the urine. Different doctors use different methods and each doctor may vary his methods. To illustrate: Dr. Joslin[1] gives the following Test and Maintenance Diets:

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[1] Joslin, "The Treatment of Diabetes."
[2] Ibid.

TABLE —TEST AND MAINTENANCE DIETS

	Diets	Total Diet				Carbohydrate (C)						Protein and Fat (PF)					
		Carbo-hydrate	Protein	Fat	Calories	5 Per Cent. Vegetables	Orange	Oatmeal	Shredded Wheat	Uneeda	Potato	Egg	Cream 20 % Fat	Bacon	Butter	Meat	
TEST	T. D. 1	181	46	44	1304	300	300	...	3	4	240	3	120	...	...	....	1
	T. D. 2	101	35	43	931	300	300	...	1	2	120	3	120	...	...	....	2
	T. D. 3	66	24	37	693	300	300	...	½	2	....	2	120	...	...	....	3
	T. D. 4	34	15	30	466	300	200	...	...	...	....	1	120	...	...	....	4
MAINTENANCE	C 1 PF 1	14	15	30	386	300	....	...	...	...	....	1	120	...	...	....	1
	C 2 PF 2	22	19	37	497	300	100	...	...	...	....	2	60	...	15	....	2
	C 3 PF 3	32	24	37	557	600	100	...	...	...	....	2	60	...	15	....	3
	C 4 PF 4	42	29	52	752	600	200	...	...	...	....	2	60	30	15	....	4
	C 5 PF 5	52	32	66	930	600	200	15	...	...	....	2	60	30	30	....	5
	C 6 PF 6	64	44	83	1179	600	200	30	...	...	....	2	120	30	30	30	6
	C 7 PF 7	74	52	88	1296	600	300	30	...	...	....	2	120	30	30	60	7
	C 8 PF 8	84	61	94	1426	600	300	30	...	2	....	2	120	30	30	90	8
	C 9 PF 9	99	65	106	1606	600	300	30	½	2	....	2	180	30	30	90	9
	C10 PF10	109	66	119	1771	600	300	30	1	2	....	2	180	30	45	90	10
	C11 PF11	135	80	135	2075	600	300	30	1	2	120	2	240	30	45	120	11
	C12 PF12	159	84	135	2187	600	300	30	1	2	240	2	240	30	45	120	12

In general, the method is as follows: When, on a given Test Diet, the urine is sugar-free, the patient is given a Maintenance Diet with the corresponding amount of carbohydrate; protein and fat are added in amounts sufficient to meet the building, repair, and energy needs of the body without sugar or fatty acids appearing in the urine. While, with the use of insulin (and even before its use), fats are used quite generously, the latter is prevented by not giving more fat or protein than can be balanced by the combustion of the carbohydrates. Carbohydrate is given chiefly in the form of vegetables and fruit. Concentrated forms such as cereal, breads and potatoes are restricted. Diets are modified, of course, as the needs of the individual may indicate.

It will be seen, by comparing the Test Diets with the preceding tables, that all, in total calories, are much below the normal needs and that the proportions of carbohydrate, protein and fat are all proportionately reduced. It will be seen also that the highest Maintenance Diet is about the minimum required by a normal man at rest, the period when the body makes least demands.

This *undernutrition* is a general rule, the diabetic patient being kept, usually, at about ten per cent. below the normal weight. With this undernutrition, it is important that all the energy provided be conserved for the necessary body activities. For instance, when the diet is low, calories must not be wasted by overexertion or exposure to cold; cold water or ice cream, even though made in accordance with the diet allowed, should not be given because calories would have to be used in warming them. In old people, conservation of energy is particularly important. For this reason fasting is usually avoided.

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[1] "The Treatment of Diabetes."

The *danger of errors*, and the responsibility of the nurse, in such a delicately adjusted and balanced diet, in which every item has a weighed value, is evident. It is plain that even the slightest error might prove serious, if not fatal.

Fluids.—Diabetic patients, untreated, are always thirsty. This is due to the large amount of water required to excrete sugar and, in acidosis, acids. Regulation of the diet relieves thirst and lessens the volume of urine. This brings comfort and allows the patient more rest and sleep. Water, tea, coffee, and clear meat broths are the usual fluids allowed. They help greatly during periods of undernutrition but must not be taken in excess. Broths should be properly seasoned; salt is good for diabetic patients and is enjoyed by them. Hot drinks are always best because they avoid the loss of calories otherwise lost in warming them. It must be remembered that the large amount of urine voided at body temperature robs the body of heat. Warm fluids are given during the periods of fasting. It may be necessary to give increased fluids, if the amount of urine voided is less than normal, in order to remove acids and prevent acidosis. At the approach of coma, liquids are given freely. Next to insulin, they are said to be "the most important factor in rescuing the patient."

Rest and Exercise.—Plenty of sleep and rest are essential in all cases. Overexertion and fatigue are to be avoided; fatigue raises the blood sugar. The habits of the individual in relation to the expenditure of energy should be carefully noted. Exercise in some form, however, is always desirable. It keeps the muscles in good condition, improves the circulation, metabolism, mental attitude and general health. By exercising, the carbohydrate tolerance is often increased. "If the patient, by means of exercise, can have 5 grams more of carbohydrate a day the added comfort will be enormous, for the addition of 5 grams of carbohydrate to a diet in a case of severe diabetes brings almost untold joy." It allows for much greater variety and helps to prevent loss of weight. Out-door exercises and those which are enjoyable and diverting give the best results. Exercise should be moderate with periods of rest following. The amount allowed depends upon the condition and the total calories in the diet. In severe cases overexertion may predispose to coma. Massage is valuable. The amount of exercise may be increased by training.

Mental Hygiene.—There seems to be an important relation between diabetes and the nervous system. It sometimes dates from a severe mental strain or nervous shock. The disease itself has a very depressing effect on the mind—the patient is apt to be morose, complaining, anxious, with a tendency to cry easily and to be upset by trivial things. The ravenous appetite, the intense craving for sweets, and starches, and the restricted diet also make him very unhappy. His conscience may be so affected that he will lie or steal to get food the body so intensely craves.

These patients are not entirely responsible for their actions or mental attitude. A normal person finds it hard to be patient, sweet-tempered and uncomplaining when the appetite is dissatisfied; how much harder must it be for the person whose will, self-control and courage are already shattered by disease? The fact that the disease is not curable is also depressing, but the patient should be cheered by the feeling that he has much to be thankful for in that the disease is painless, clean, and not unsightly like many others, and that he himself can control it by strictly following the doctor's orders. Quiet, freedom from worry, emotional strain, mental excitement, or fatigue are essential. Any nervous strain predisposes to coma. "It is dangerous to get angry." Arteriosclerosis is usually present in diabetes, particularly in the severe forms, and greatly adds to the danger of nervous strain (see arteriosclerosis). Sleep and mental diversion, such as reading, writing, games, conversation with friends and work which does not cause fatigue are valuable.

A nurse should interpret complaining, ingratitude, and the above characteristics, chiefly as symptoms of the disease and should welcome a more cheerful attitude as a sign of improvement in the patient's condition.

Care of the Skin and Prevention of Infections.—It is extremely important to keep the skin in good condition, active, clean, warm, free from irritation, slight wounds, infections, bedsores, or gangrene. It is apt to be dry and harsh due to loss of water in the urine. Its function is interfered with, metabolism in the tissues is poor and diabetics are very susceptible to infections such as boils and carbuncles, etc. Intolerable itching and eczema sometimes occur. The urine is irritating and may cause pruritus. Increased blood-sugar causes arteriosclerosis and this may cause many of the capillaries to disappear so that the tissues are poorly nourished; bedsores and gangrene may result. Emaciation adds to the danger of bedsores. Any break in the skin heals with great difficulty. It must be kept scrupulously clean by daily baths and its function stimulated by warmth, exercise, massage and by giving plenty of water to drink. Special care must be taken of the extremities where the circulation is most apt to be poor. Gangrene may be prevented by the above measures, by the proper dietary treatment, by avoiding conditions which lead to arteriosclerosis, and by improving the circulation by warmth and exercise. The feet require special care. They must be clean, warm, and dry, especially between the toes, and the skin and nails must be kept soft by soaking in warm water and by the use of lanolin around the nails. If the feet are too soft and tender, alcohol may be used to harden them. Corns and callosities should be treated, never cut, and the nails should be cut straight across. The feet are sometimes elevated to avoid congestion; any sign of inflammation should be reported immediately. All clothing worn by the patient should be clean and warm but light in weight. Shoes should be selected with care.

Care of the Mouth and Teeth is also most important. Owing to the loss of water in the urine, the mouth is usually dry; thirst is distressing. The tongue is dry, red and glazed. The gums may be swollen. Stomatitis sometimes occurs. The teeth are often in poor condition, which increases the severity of the diabetes. The mouth always harbors germs and, as before stated, diabetics are very susceptible to infections and frequently die from complications such as tuberculosis, lobar or bronchopneumonia. They must be kept clean, the teeth properly cared for, and injury to the gums avoided. All infections—colds, tonsillitis, influenza, boils, etc.—favor the onset of coma, lower the carbohydrate tolerance, and interfere with the treatment of the diabetes. In tuberculosis, for instance, the diet is increased and overweight is desirable; in diabetes the diet and weight are always kept slightly below normal. The patient should never be exposed to infection, but particularly when on a low diet. Diabetes always grows worse with infection. A nurse with a cold should not take care of a patient with diabetes.

Body Eliminations.—The function of the kidneys and skin must be kept active and the bowels kept open. Constipation is common and predisposes to coma.

Collection of Urine Specimens.—The importance of examining the urine and care in the collection of specimens is indicated in the foregoing discussion. The diagnosis and whole regulation of the treatment are based upon these findings and upon examinations of the blood. Nurses are responsible for the accurate collection of specimens. Both single and twenty-four hour specimens of urine are examined. Sometimes each specimen voided in the twenty-four hours is examined separately. This is especially necessary in severe cases of diabetes when insulin is given. "The dosage of insulin in these cases is determined entirely by the results of the analysis of the last voided specimen. It is, therefore, imperative that all the urine be carefully collected and sent to the laboratory on time. In less severe cases or less severe stages of the disease it becomes necessary to study the variation in sugar output in relation to meals in order that the dosage of insulin may be adjusted to meet the needs of the individual patient. Under these circumstances the urine from each meal period and the night specimen must be collected in four separate fractions: (1) From 7 A.M to 11 A.M.; (2) 11 A.M. to 4 P.M; (3) 4 P.M. to 9 P.M.; (4) 9 P.M to 7 A.M. Failure to collect these specimens at the proper time will cause considerable delay and therefore added expense to the patient, or may result in serious "insulin shock." Each fractional or twenty-four hour specimen must be closed within one-half hour of the end of the period. Specimens must be kept cool to avoid decomposition. Sugar tends to fermentation which causes loss of sugar and makes the test inaccurate. Specimen bottles should be scalded daily and kept scrupulously clean. A preservative (½ teaspoonful of thymol to a 2 quart bottle) is usually used.

Symptoms to be Watched For and Reported.—*Symptoms of Coma.*—Patients who die of diabetes die in coma. Coma may usually be prevented if the early symptoms are noted and relieved. It is very difficult to cure once developed except by use of insulin. As stated previously, it is due to acid intoxication resulting from the faulty metabolism of fat, and also, some think, of protein. The onset may be favored by various factors which are therefore to be avoided. These may be an ether anesthesia, impaired function of the kidneys and failure to eliminate the fatty acids, constipation, mental excitement, infections, fatigue, exposure and chilling, overeating, fasting, sudden changes in the diet, improper regulation of the diet, such as cutting down the carbohydrates only or a sudden increase in the fats with a low carbohydrate diet (for without carbohydrates fats cannot be burned), or failure to use the proper amount of insulin. "With an excess of fat diabetes begins and from an excess of fat diabetics die."

The *Symptoms.*—The onset is frequently very indefinite and sudden. The utmost vigilance in observation and promptness in treatment is essential as in all emergency situations. *Dyspnea, diabetic air-hunger,* in which the breaths are deep and straining, is one of the most important. It is an effort of the body to get rid of carbon dioxid or carbonic acid in order to lessen the acidity and keep the reaction of the blood normal. Other symptoms are loss of appetite, nausea, vomiting, headache, listlessness, drowsiness, weakness, vertigo, ringing in the ears, disturbance of vision, excitement or delirium. The *blood* will show an increased percentage of fat. The *urine* will show the presence of β-oxybutyric acid or diacetic acid or acetone, both of which are derived from the former. β-oxybutyric acid indicates diabetes in the most severe form.

The *Treatment.*—The best treatment is *prevention,* avoiding the conditions which predispose to, or deepen the coma. With the first symptoms of acidosis the doctor should be notified and the patient must go to bed and be kept warm. If the symptoms become more severe, saline solutions are given by hypodermoclysis, intravenously, intraperitoneally, or by rectum to counteract dehydration of the tissues. Insulin is given to oxidize glucose and prevent the catabolism of fats, protein, and body tissues. Glucose solution (50 per cent. solution in severe coma) is given intravenously and sometimes by rectum to supply fuel and prevent the combustion of fats. When given by rectum it is slowly absorbed and oxidized so the tissues can handle it more easily. If vomiting preceded coma, the stomach and bowels are washed out. Large amounts of orange juice are given as soon as the patient can swallow and hot drinks in the form of broths and black coffee. The patient is catheterized, if necessary, and the urine is examined every two hours for sugar and diacetic acid. The patient is kept warm, the pulse is watched closely and heart stimulants are given if indicated. Some doctors give a solution of bicarbonate of soda by rectum or intravenously to neutralize the acidity of the blood—other doctors consider this harmful. Patients, and their relatives, should thoroughly understand the symptoms and should be instructed in the emergency treatment of acidosis.

Symptoms of Complications, which are apt to occur and from which the patient may die, should be recognized immediately. The most common complications are pneumonia, tuberculosis, nephritis, boils, carbuncles, abscesses, pruritus and gangrene.

The **Value of Insulin in Diabetes.**—Insulin is not a substitute for the treatment outlined above, but is an aid of immeasurable value in bringing about the desired results more quickly and surely, and with less demands upon the courage and self-control of the patient. By promoting the combustion of carbohydrate it enables the patient to have a more normal diet and to live a more normal, comfortable and useful life free from the distressing mental and physical symptoms outlined above.

Danger in Using.—Insulin is a very potent factor with power of death as well as life. It must be used with the greatest caution and exactitude. The slightest error in dosage, time and frequency of administration, or in the diet, to which it bears a direct relation, or anything which interferes with the absorption of the diet, such as vomiting or diarrhea, or anything which makes greater demands upon the patient's energy, such as cold, overexertion, or emotional disturbances, may prove serious or even fatal.

1. *Danger if Insufficient or Omitted.*—If the amount of insulin given is not sufficient to balance the diet, or if a dose is omitted without regulating the diet, the result will be *glycosuria, acidosis* and *coma.* Patients should be warned of this danger and an adequate supply should always be kept on hand.

2. *Danger of Overdosage.*—If the above factors are not considered and the amount of insulin given is in excess of that required for the combustion of available carbohydrates, the result will be *hypoglycemia,* a very grave danger of impending death. Every patient should be warned and become thoroughly familiar with the early symptoms of hypoglycemia and instructed in the emergency treatment.

Symptoms of Hypoglycemia.—Symptoms usually occur when the level of blood sugar drops to about 0.08 per cent. and increase as the level falls. The *early symptoms* are described as follows: "a vague, indefinite feeling of uneasiness, an uncomfortable sense of impending danger. A peculiar masklike immobility of the face with dilation of the pupils is often seen. Marked hunger may often be complained of. Increase in pulse rate, with weakness, pallor, flushing, nervousness, and tremulousness are early evidence of hypoglycemia." *Later symptoms,* as the blood sugar falls: "nervousness gives place to anxiety and faintness; excitement and emotional disturbances with occasional vertigo may occur. The physical signs at this stage include sweating, often most profuse, diplopia and incoördination. Marked excitement, emotional instability, sensory and motor aphasia, delirium, disorientation, delusions, confusion and bradycardia occur with blood sugar levels of 0.055 to 0.040 per cent." Unconsciousness and collapse may occur. The patient should be watched constantly but particularly during a long period between meals, as in the early morning hours and during sleep.

The *Treatment of Hypoglycemia* is to replace the amount of glucose in the blood and to lessen the demands upon it. The doctor must be notified and the patient go to bed. In the early stage the juice of one-half to one orange is given. In the sweating stage, concentrated glucose, such as one or two level tablespoonfuls of corn syrup, repeated in ten minutes if necessary, and in the more severe three or four tablespoonfuls may be given. In severe forms, when the patient is unconscious, a 50 per cent. solution of glucose may be given intravenously.

Tremor, twitchings, and marked mental irritability mark recovery from unconsciousness.

The Dosage of Insulin, Time and Frequency of Administration.—No set rules can be given as the dosage, etc., varies with the diet and with each individual, and at different times for the same individual. Doctors differ, also, in their methods of prescribing insulin. For the nurse, it is important to see that the treatment is carried out exactly as prescribed—any departure from this should be reported immediately.

Method of Administration.—Insulin is given by hypodermic injection except in coma when it may be given intravenously. All the usual precautions in giving hypodermic injections—to have a fine, very sharp needle, to avoid trauma and pressure points, to introduce it into loose subcutaneous tissue and never *into* the skin or muscle tissue, or to give successive doses into the same spot—should be specially emphasized. The patient or a relative should be taught full particulars in regard to giving hypodermic injections of insulin at home.

Symptoms of sensitization to the protein of insulin—itching, urticaria, swelling of the lips, reddening of the eyes, puffiness of the face, weakness, epigastric pain, nausea and vomiting—should be watched for.

The **Importance of Records.**—Accurate, complete records are essential in the care of diabetic patients. All subjective and objective symptoms are significant and all facts relating to the treatment, especially to the diet, the intake and output of fluids, urine specimens, rest, sleep, exercise, the insulin given in relation to the diet, the intervals between meals, the patient's height, daily weight, and general condition, are all important.

Urine Tests in Diabetes.—A nurse in a private home, when caring for a patient suffering from diabetes or when engaged in public health work, visiting nursing, or in a doctor's office, may be required to examine the urine for sugar, acetone, diacetic or β-oxybutyric acids. The following simple tests may be used:

Tests for Sugar:

1. *Fehling's Test.*—Put about 3 c.c. of urine in a test tube. Add about 5 c.c. of boiling Fehling's solution, then boil the mixture and place the tube in the rack. The formation of a typical red or golden yellow precipitate indicates the presence of sugar.

2. *Benedict's Test.*—Put 5 c.c. of the reagent and eight drops of urine in a test tube. Immerse the tube in a water bath of boiling water and keep the water boiling. At the end of exactly five minutes remove the tube and allow it to cool. If the fluid becomes opaque, it indicates that sugar is present. If no sugar is present the fluid remains clear or only a faint turbidity results due to urates.

These tests are based upon the fact that sugar is a reducing agent, that is, it will precipitate or separate heavy metals from their compounds. Fehling's solution, for instance, is a compound containing copper, which when precipitated gives the usual copper color to the solution. The Benedict test is a more sensitive one than Fehling's because the reagent is not reduced by uric acid, creatinin, and other substances which are in the urine, as Fehling's solution may be.

Test for Acetone.—Drop a crystal of sodium nitroprussid in 5 to 10 c.c. of water. Add 1 to 2 c.c. of this solution and a few drops of glacial acetic acid to 5 c.c. of urine and stratify strong ammonia over the mixture. A purple ring at the junction of the fluids indicates that acetone is present.

Test for Diacetic Acid.—Add a few drops of 10 per cent. ferric chlorid to about 10 c.c. of urine, drop by drop. If a precipitate forms, filter and add a few more drops of ferric chlorid. A "Burgundy" red indicates that diacetic acid is present. If the patient has been taking phenol, salicylates, aspirin, acetanilid or antipyrin, a dark color will also be produced on the addition of ferric chlorid to the urine, but it will be a purple rather than a red as when due to diacetic acid.[1]

Medical Emergencies

Syncope.—The word syncope comes from a Greek word, *synkope,* which means a cutting short, a swoon or fainting. It is a condition of more or less complete unconsciousness due to anemia of the brain resulting from a sudden fall of blood-pressure or failure of the heart to maintain the circulation.

The *causes* of the cerebral anemia may be:

1. Lowered blood-pressure from the actual loss of blood as in a hemorrhage.

2. Lowered blood-pressure from a weakened heart action which fails to maintain the circulation and allows the blood to accumulate in the veins. This is called "bleeding into the veins" and is the condition of the circulation after death, the venous system

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[1] "St. Luke's Hospital Laboratory Technique."

being so large that it will contain, when completely relaxed, all the blood in the body. The effect on the heart, brain, and body tissues is the same as when blood is actually lost.

The weakened heart action may be the result of heart disease or of some temporary weakness resulting from depression of the nervous system as from the action of drugs, or fear, or worry, etc., or from physical exhaustion as from hunger, overexertion, or slight exertion when in a weakened condition. Fainting, as a result of a sudden change in position from the recumbent to the upright, when the nervous system is depressed, as in jumping out of bed when half-awake, or in the old in whom the circulation is not readily adjusted has already been mentioned in an earlier chapter.

3. The lowered blood-pressure and weakened heart action may be due to stimulation of the vasomotor center resulting in a marked change in the distribution of blood in the three great reservoirs of the body—the skin, intestines, and muscles. In fainting, the skin is blanched and the body surface is cold because the blood vessels of the skin (and of the intestines) are contracted and the blood is driven into the dilated vessels of the muscles. It is stated (Brunton) that the blood vessels of the muscles are large enough to allow as much blood to pass through them, in a given time, as through the vessels of the skin and intestines together. The rapid passage of blood from the arteries to the veins lowers the blood-pressure. Anemia of the brain follows.

This explains fainting as the result of severe pain, fright, joy, the sight of blood, or of an accident, all of which directly or reflexly stimulate the vasomotor center.

The *Symptoms.*—A feeling of weakness and dizziness with roaring in the ears may precede the attack or the patient may suddenly feel weak and fall, unconscious, to the ground. The face and lips are blanched, the eyes are closed, the body surface is cold and clammy, the muscles are completely relaxed, the pulse is weak and small, and the respirations are shallow.

The *Treatment.*—In most cases merely lowering the head between the knees or placing the patient flat on his back with the head low, will prevent an attack or revive a patient. Fresh air should be admitted freely to the patient and all clothing should be loosened about the neck, chest, and waist. The respirations may be stimulated reflexly by giving inhalations of smelling salts or ammonia, by sponging or dashing cold water over the face and chest, or by friction to the chest with the hand moistened in cold water, or by slapping the chest smartly with the hands or end of a cold wet towel. Heat applied for a brief period over the heart will increase the force and rate of the heart beat and stimulate the circulation. Heat applied to the neck, head and face will increase the supply of blood in the head and excite the mental activities.

When consciousness is regained and the patient is able to swallow, water, aromatic spirits of ammonia, whisky, or a hot drink should be given.

After an attack of syncope, the patient should not attempt to sit up or walk about, but should lie quiet and at rest until the circulation is reëstablished.

Collapse.—The pathology, symptoms and treatment of collapse are the same as in shock. The conditions are identical but the term collapse is usually used when the prostration is the result of disease whereas the term shock is used when it is the result of a surgical condition such as an accident or operation. (See shock, Chapter XXXII.)

Asphyxia.—The word asphyxia comes from the Greek prefix, *a,* meaning an absence of, and *sphyxis,* meaning pulse. It is a condition of unconsciousness due to suffocation or interference of any kind with the oxygenation of the blood.

The *causes* of asphyxia may be:

1. Mechanical interference with the entrance of air to the lungs which may be (1) inflammation and swelling of the throat and larynx or the formation of a membrane as in diphtheria; (2) edema of the glottis in diphtheria, tuberculous laryngitis, cardiac and renal diseases; (3) foreign bodies in the respiratory tract; (4) pressure on the trachea or bronchi from goiter, tumor or aneurysm; (5) water and mucus, etc., in the respiratory tract as in drowning.

2. The inhalation of smoke, or poisonous gases such as coal-gas or illuminating gas, or the fumes of ammonia, or nitric acid, or the inhalation of ether in a general anesthetic.

3. Interference with the interchange of gases between the blood and air in the lungs as in diseases of the heart or lungs, and in poisoning from carbon monoxid in which the hemoglobin is saturated with the gas and cannot combine with oxygen.

4. Weakness of the respiratory muscles, or convulsive spasms as in croup or whooping-cough, or paralysis as in diseases or injuries involving the upper part of the spinal cord.

5. Weakness of the respiratory center in the medulla. The work of the respiratory center (and other centers in the medulla) depends upon the amount and character of the blood flowing through it. It is stimulated by venous blood.

6. Failure of the lungs to expand in the new-born.

The *symptoms* of asphyxia develop in three stages: In the *first stage,* the venous blood flowing through the medulla stimulates the respiratory center, making the breathing more rapid (hyperpnea), labored (dyspnea), and distinctly audible. Respiratory muscles not used in quiet breathing are forced into action. The appearance of the patient is alarming—the lips are blue, the face congested, the eyes prominent and bloodshot and the expression is anxious. The venous blood also stimulates the vasomotor center so that the blood-pressure is raised owing to the contraction of the peripheral blood vessels. This stage lasts about one minute.

The *second stage* is the stage of convulsions due to the further stimulation of the centers in the medulla by the venous blood. This stage lasts less than one minute.

The *third stage* is the stage of exhaustion. The patient becomes unconscious, the muscles flaccid and the pupils widely dilated. The blood-pressure falls and the pulse is almost imperceptible due to heart failure. The inspirations are prolonged and sighing and the intervals between increase until breathing finally ceases. Death results from gradual exhaustion and paralysis of the centers in the medulla from the prolonged action of the venous blood. The third stage may last three minutes or more.

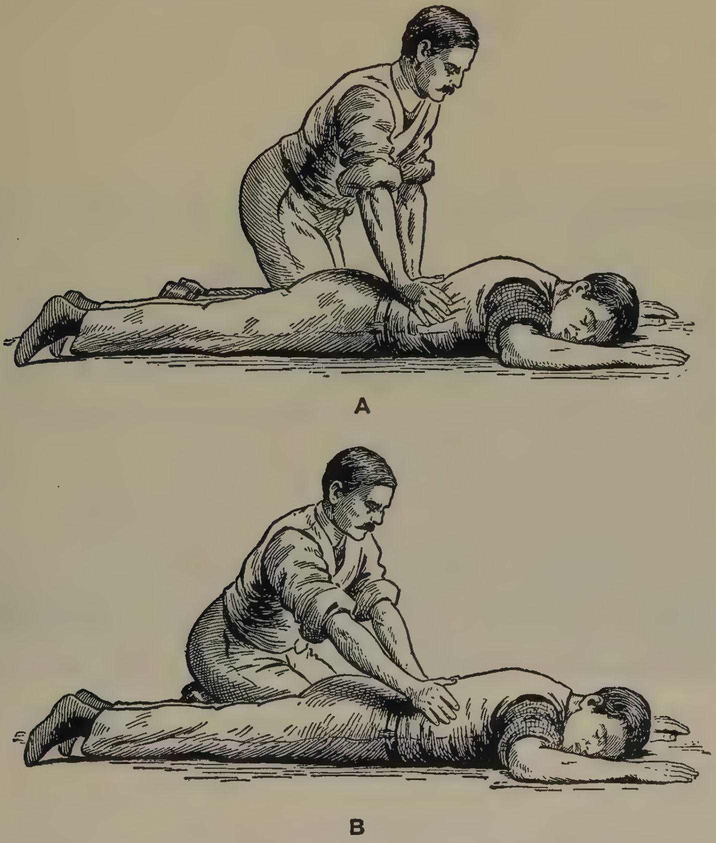

Fig. 126.—Artificial Respirations: The Two Principal Positions, A and B, in Performing Schäfer's Method. (From Halliburton's "Handbook of Physiology," Blakiston and Son, Publishers.)

After death the veins are found engorged and the arteries empty.

The *Treatment.*—The first step is to remove, if possible, any obstruction to the free passage of air. If the obstruction is due to fluid in the lungs and bronchi, as in drowning, the patient's clothing should be loosened about the neck, chest, and waist, and he should then be turned on his face, and his body raised at the waist-line by means of a folded blanket or clothing. Pressure should then be applied, with both hands spread out, upon the lower chest wall to expel water from the stomach and lungs, and to allow it to run out by gravity from the trachea and mouth. The nose, mouth and throat should be cleansed of mucus.

In all cases of asphyxia, the treatment consists in removing anything which might interfere with breathing, in establishing natural respiration with the least possible delay, and in treating the patient for shock. He should be kept warm and should have plenty of fresh air. His clothing should be loosened about the throat, chest, and waist, and his position must be such as to keep the air passages wide open for the admission of air (see care of the patient under a general anesthesia), and to allow for the free expansion of the lungs. Foreign bodies (such as false teeth) or mucus should be removed from the mouth or throat. Artificial respirations should be begun without delay.

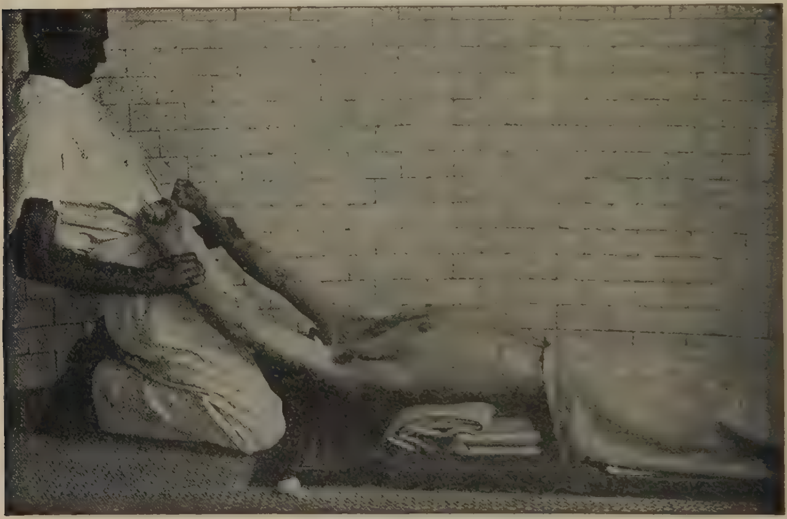

Fig. 127.—Artificial Respirations. Sylvester's method. Inspiration (DaCosta). (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

Artificial Respirations.—There are several methods of giving artificial respirations (that is, starting up respiration in a person in whom it has ceased) among which are the Sylvester, Schäfer, Laborde, Howard, and Marshal Hall methods. A nurse should become familiar with one or more methods and should practice giving them. Speed in action and perseverance are essential. Two methods commonly used are the Schäfer and the Sylvester methods.

The *Schäfer* or the *"prone-posture method"* saves labor and is said to be the simplest, most effective, and least injurious. The method is best described in the words of the author, as follows: "It consists in laying the subject in the prone posture, preferably on the ground, with a thick folded garment underneath the chest and epigastrium. The operator puts himself athwart or at the side of the subject, facing his head, and places his hands on each side over the lower part of the back (lowest ribs). He then slowly throws the weight of his body forward to bear upon his own arms, and thus presses upon the thorax of the subject and forces air out of the lungs. This being effected, he gradually relaxes the pressure by bringing his own body up again to a more erect position, but without moving the hands." The movements are repeated regularly at a rate of twelve to fifteen times a minute until normal breathing begins or until the possibility of its restoration is abandoned. Efforts to revive the patient should be continued for an hour or more.

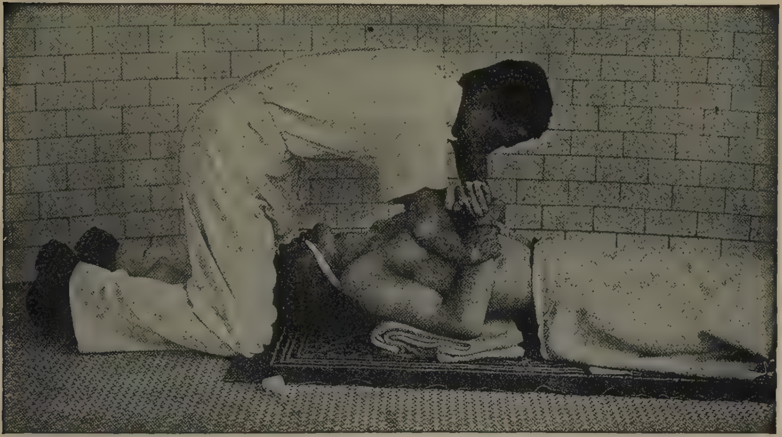

FIG. 128.—ARTIFICIAL RESPIRATIONS. Sylvester's method. Expiration. (DaCosta). (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

The *Sylvester method,* frequently used, consists in loosening the clothing, removing mucus or foreign bodies from the mouth or throat and placing the patient flat on his back with a pillow or folded blanket between the shoulders so as to raise the chest, extend the trachea, throw the head back and keep the air-passages open. The tongue should be grasped and held well forward by an assistant. The operator kneels at the head facing the feet of the patient and, grasping both elbows, moves the arms slowly outward from the body and upward above the head as far as they will go. This causes the expansion of the chest or inspiration. The arms are held in this position for a few seconds then brought toward each other, then downward to their original position against the floating ribs, making pressure upon them so as to cause the expulsion of the air or expiration. These movements are repeated at the rate of normal respiration and efforts to revive the patient should be continued for an hour or more.

Laborde's method consists in applying rhythmic and forcible traction to the tongue. The object is, through stimulation of sensory nerves in the tongue, to reflexly stimulate the phrenic nerve and thus cause contractions of the diaphragm and thereby establish voluntary respirations. In this method the tongue is grasped with forceps (or with the fingers after wrapping gauze around the tongue to keep it from slipping) and is pulled well forward and upward from ten to fourteen times a minute until voluntary respiration is established.

This method is particularly valuable when an injury to the chest, arms, or shoulders prevents the use of the Schäfer or Sylvester methods.

Any patient requiring artificial respirations is in a serious condition and is suffering more or less from shock for which treatment will be required. In cases of drowning, particularly, the patient will be suffering from shock due to cold and prolonged exposure, exhaustion and fear of death.

As soon as breathing has been established, the wet clothing should be removed and the patient wrapped in dry, warm blankets. Heat should be applied to the extremities and friction with a warm towel to stimulate the circulation. Whisky or brandy may be given by rectum, stimulants may be given by hypodermic, and heat or a mustard paste may be applied over the heart to stimulate the heart and circulation. As soon as he is able to swallow, hot coffee, whisky or brandy may be given by mouth.

The patient should be kept quiet and in bed until fully recovered.

The *pulmotor* and *lungmotor* are mechanical devices used in giving artificial respiration. They are used by a doctor only, so need not be discussed here.

Sunstroke or insolation results from exposure, especially of the head and neck, to the direct rays of the sun.

The sun's rays have a powerful effect on the body, elevating the body temperature and acting as a powerful excitant to the brain and all nerve centers. Marked congestion and swelling of the face, scalp, meninges, and brain occur.

Some authorities think that the attack is due to the direct effect of the *heat rays* of the sun on the nerve centers while other authorities believe the attack to be the result of the action of the *chemical* or *violet* and *ultraviolet* rays which penetrate the skull.

The *symptoms* are violent headache, mental excitement which may become maniacal, convulsions, and loss of consciousness. The attack may prove fatal or, if the patient recovers there may be permanent impairment of the mind with loss of memory or power to concentrate, together with other nervous disturbances, and inability to stand exposure to heat.

Heat-stroke differs from the above in that the person need not be exposed to the direct rays of the sun. It results from exposure of the body to a high external temperature from any source, especially when the air is saturated with moisture. It may occur at midnight or in a close, poorly ventilated room. The condition is more apt to develop in debilitated persons or in persons engaged in hard physical labor, especially in those who are in the habit of drinking beer or whisky, and whose clothing does not allow for sufficient heat elimination by the rapid evaporation of moisture from the skin.

The *symptoms,* as described by Dr. W. G. McCallum, are as follows:

"The mildest effect (heat prostration) consists in headache, moderate rise in temperature, pains in back and limbs, and extreme exhaustion. More severe is the asphyctic form, in which great dyspnea and cyanosis, with delirium or unconsciousness are added to these symptoms. Still more severe, and frequently fatal, is the hyperpyretic type, in which unconsciousness and collapse come on suddenly, or after several days of vague premonitory symptoms. There are convulsions, delirium, or profound coma with shallow and gasping or very deep respiration, and finally failure and stoppage of the heart. The skin, at first covered with sweat, becomes hot and dry, and the temperature rises to phenomenal levels." Cases are reported having a temperature of 108° to 112° F. and even as high as 117.6° F.

It is thought that the extreme hyperpyrexia or thermic fever, in the above condition, is due to the impairment or paralysis of the heat-regulating centers in the medulla and that this paralysis, together with the failure of the heart and respiration, are the result of overheating from the extreme external heat on the nerve centers in the medulla. As a result of this paralysis, heat rapidly accumulates in the body with no adequate provision made for its elimination.

The *treatment* in the above conditions consists in lowering the body temperature by increasing heat elimination and preventing further heat production.

The patient should be removed to a quiet, cool place and placed in bed in the recumbent position as soon as possible. His head should be slightly elevated. His clothing should be loosened and entirely removed. Cold applications should be applied continuously to the head and neck, in the form of compresses or an ice-bag, etc., and to the entire body in the form of cold sponges, effusions, baths or packs. Brisk rubbing should be applied so as to bring the hot blood to the skin. Cool enemata may also be given. The treatments are continued until the temperature drops to 101° F., after which the patient lies quietly in bed, covered with a sheet only. In giving the treatments, care is taken not to cause the temperature to fall below normal and cause collapse. The pulse must be closely watched throughout for symptoms of collapse.

When the cold applications are removed, the patient's temperature must be watched constantly as it is likely to rise again rapidly and the treatments will have to be resumed.

In addition to the above treatment, the early removal of blood by bleeding followed by an intravenous injection of hot normal saline may be necessary in persons in whom the pulse is bounding and the face cyanotic.

Even after the temperature has been permanently reduced, the patient requires extreme care on account of the danger of cerebral congestion, meningitis and secondary changes and impairment of the functions of the brain which may follow. An ice-cap should be kept on the head. Rest, quiet, fresh air, and careful regulation of the diet and body eliminations are essential.

Exposure to the sun or any form of heat should in future be avoided as one attack predisposes to another.

Heat Exhaustion differs from the above, in that, while it may be produced by the same conditions, the result or effect on the patient is different.

It is thought that heat exhaustion is due to paralysis of the vasomotor center in the medulla as a result of the extreme heat.

The *symptoms* are those of collapse—a subnormal temperature usually, a pale, cool, moist skin, a weak, rapid pulse, marked weakness or extreme prostration. As a rule, the patient does not lose consciousness although syncope may occur. There may be restlessness and, in severe cases, delirium.

The *treatment* is directed toward raising the body temperature and in treating for collapse. The patient should be placed in the recumbent position with the head low; the clothing should be loosened, fresh air freely admitted, and external heat applied in the form of hot blankets, hot-water bottles, a hot bath or pack, and a hot enema. Hot tea or coffee may be given to drink and cardiac stimulants such as aromatic spirits of ammonia, caffein or strychnin. The body temperature must be watched closely in order to avoid an elevation above normal as a result of the hot applications.

Rest and quiet are essential until the patient is fully recovered.

Meningitis and other serious after-effects are not so apt to occur as after a sunstroke, but it may be a long time (weeks or months) before the patient completely recovers. He should be watched closely and every effort made to build up the general health. Tonics are frequently required.

Convulsions.—Convulsions are violent, involuntary muscular contractions. The contractions may be continued or intermittent and may be local or general.

Convulsions may be classified according to (1) the character of the contractions; (2) as to whether they are local or general; and (3) the cause of the convulsion and origin of the irritation; that is, whether the convulsion is due to irritation or irritability of the motor centers of the brain or of the spinal cord.

Character of the Contractions.—Contractions which are intermittent, the muscles alternately contracting and relaxing, are called *clonic*. The movements are abrupt and jerky.

Contractions which are long continued are called *tonic*.

Both tonic and clonic contractions may occur in the same convulsion and frequently follow each other.

Coördinate contractions are clonic contractions in which the movements seem purposeful. They are an exaggeration of the natural contractions.

Local convulsions may be confined to one or a group of muscles. They are usually called spasms. Spasms may involve the muscles of the face, arm, leg, hand (as in writer's cramp), neck (as in wry-neck or torticollis), larynx, esophagus or diaphragm (hiccough).

Cause and Origin of the Irritation.—Convulsions which result from excessive irritation or irritability of the motor centers of the brain are characterized by loss of consciousness. They are called *epileptiform* convulsions and are commonly spoken of as *fits*. The contractions are chiefly clonic but may be preceded by a short tonic contraction. The convulsions are general.

Epileptiform convulsions may be caused by: (1) Idiopathic epilepsy; (2) injuries to the head with concussion, laceration of the brain, or pressure on the brain from hemorrhage or a fractured skull; (3) organic brain diseases due to meningitis, syphilis, tumors, abscesses or apoplexy; (4) toxic substances in the blood as in the acute infections, alcoholism, uremia and in poisoning by certain drugs; (5) reflex irritation as in the convulsions in young children resulting from gastric disturbances, intestinal parasites, teething, an adherent prepuce, the onset of an acute disease, or any condition accompanied by a rise in temperature; (6) cerebral anemia resulting from a profuse hemorrhage or from certain forms of heart disease.

In convulsions resulting from irritation of the motor centers of the spinal cord there may be no loss of consciousness or only partial loss. A slight stimulus such as a noise, light, or contact with cold may cause a violent convulsion owing to the stimulated reflexes and irritability of the spine. The convulsions are called *tetanic* or tonic convulsions. Prolonged tonic contractions are characteristic but both clonic and tonic contractions may occur.

Tetanic convulsions may result from: (1) Tetanus or lockjaw; (2) cerebrospinal meningitis; (3) strychnin-poisoning; (4) tetany.

Hysteric convulsions are manifestations of hysteria, a disease of the nervous system. The convulsions may simulate those of epilepsy or any of the above forms, so are not characteristic. They differ from those of epilepsy and other convulsions originating in the centers of the brain in that while the eyes are closed and the patient may seem to be unconscious he seldom loses consciousness completely and will often respond to suggestion. For instance, a patient may recover on hearing a suggestion to pour a bucket of cold water over him. Suggestion is one of the methods used in treating hysterical patients. Other points of differentiation are that the movements are usually tonic, not clonic, the pupils react to light, there is no involuntary passage of urine, biting the tongue, frothing at the mouth, change in the pulse or in the color of the face. The patient may fall but in a place and manner in which he cannot hurt himself. In convulsions from other causes, a patient may receive severe injuries in falling. The attacks of hysteric convulsions are usually not sudden; there may be screaming, laughing or crying during the attack and it may be more prolonged than in epilepsy and other forms. After recovery, the patient is often excited, restless, and emotional, and may laugh or cry, whereas in epilepsy the patient usually sleeps for an hour or more after the attack.

Eclampsia is a sudden attack of general convulsions usually of the epileptiform type. The term is applied to the convulsions occurring in infancy as a result of reflex irritation, and to those occurring in women during pregnancy, labor, or the puerperium as a result of toxic materials retained in the blood.

The Treatment.—Coolness, presence of mind, and promptness in action are necessary in the treatment of convulsions from any cause. The patient should be placed in the recumbent position with his head slightly elevated and in a place (in bed if possible) where he cannot hurt himself. His movements may be guided so as to prevent injury to himself but should not be restrained. A gag should be placed quickly between the teeth to prevent him from biting his tongue. His clothing should be loosened and fresh air admitted freely.

A patient should never be left alone while in a convulsion. The symptoms of the attack should be carefully noted and reported to the doctor on his arrival. Further treatment must depend upon the diagnosis and will be ordered by the doctor.

The *chief points to observe* about convulsions as an aid to diagnosis are as follows:

1. The time of the attack.
2. The onset of the attack, whether sudden, or preceded by a warning, or by nervous or emotional disturbances.
3. The character of the contractions, whether tonic, or clonic, whether one form follows the other, or whether the movements are coördinate or not.
4. The area involved, whether local or general, and if local the part affected.

5. The muscles first affected and the order in which other muscles are involved.

6. The frequency and duration of the convulsion.

7. Whether the patient is hypersensitive, conscious, semi-conscious, or totally unconscious.

8. Relaxation of the sphincters with involuntary movements of urine or stools.

9. The appearance of the eyes, whether closed or open, fixed, squinting, the pupils dilated, contracted or irregular.

10. The appearance of frothing at the mouth.

11. Any change in the pulse, respiration, or the color, or expression of the face.

12. The condition of the patient following the convulsion.

Convulsions in children have the same significance as a chill in an adult. They may mark the onset of an acute infectious disease such as scarlet fever or pneumonia, or may be a symptom of cerebral diseases such as meningitis, hydrocephalus, a brain tumor or abscess; or may be due to some minor cause such as teething, or constipation, or to violent emotion in a nervous, excitable child. Owing to their unstable nervous system minor causes of irritation may cause a convulsion in children.

The Treatment.—A doctor should be summoned immediately. During the convulsion the child should be placed in a hot bath (98° to 105° F. for 1 to 2 minutes) or a mustard bath or pack in order to relax the muscles. Cold applications should be applied to the head. When the attack is due to gastro-intestinal disturbances a lavage may be given and a hot enema followed by a purgative—castor oil is commonly used. The child should be watched closely following the convulsions and preparations made ready for repeating the treatments, as the attacks are apt to recur.

The symptoms and treatment of poisoning from the use of various drugs may be found in the text-book on materia medica supplied to student nurses.

Apoplexy is a typical example of a spontaneous intracerebral hemorrhage from the rupture of a diseased artery due to arteriosclerosis or miliary (very minute) aneurysms. The hemorrhage usually occurs from a branch of the middle cerebral artery which supplies the lenticular nucleus and the internal capsule. In order to understand the cause, symptoms, dangers, and treatment of apoplexy it is necessary to recall the following anatomical and physiological factors:

1. The middle meningeal artery lies over or close to the *motor area* of the cortex so that the hemorrhage will cause compression of these cells with resulting paralysis of muscles of the opposite side of the body.

2. The *internal capsule* is that part of the medulla at the base of the brain between the basal ganglia, which connects the cells in the cortex with those in the spinal cord and with muscles of the opposite side of the body. A hemorrhage here with result-

ing pressure on the nerve fibers will cause paralysis of the opposite side (hemiplegia).

3. The terminal arteries of the cortex anastomose freely but the small branches of the middle cerebral artery in the internal capsule do not anastomose and are terminal. Obstruction or interference with the circulation here will, therefore, cause death of the tissue supplied by the artery injured.

The accumulation of blood will cause pressure on the brain cells and nerve fibers with resulting unconsciousness and paralysis.

This pressure impedes the circulation in the veins of the brain, the *blood-pressure* is increased to overcome this resistance, but if the hemorrhage is not soon checked the pressure of the accumulating blood may involve the vital centers in the medulla and become too great for the heart to overcome, and death is the result.

Etiology of an Intracerebral Hemorrhage.—An apoplectic fit or stroke occurs in middle advanced life because of the natural tendency to degeneration of the blood vessels.

All the factors inducing arteriosclerosis—old age, the abuse of alcohol, overeating, syphilis, prolonged exertion and overwork, mental or physical—predispose to apoplexy. It is more common in men because of the more frequent indulgence in alcohol and because of occupations requiring muscular exertion.

The exciting cause may be a sudden strain, strong emotions, worry, excitement, or a sudden "fit of bad temper" to which patients with arteriosclerosis and a high blood-pressure are subject. This is probably due to interference with the circulation in the brain with the resulting effect on the cells.

A nurse must constantly keep this in mind and prevent, if possible, all slight irritations or vexations for it is the seemingly trivial things which bring on the "fit of temper," and may cause the premature death of an otherwise healthy, beloved, valuable member of society. A nurse should always be very patient with old people. Some degree of arteriosclerosis is always present so that the poor supply of blood to the brain cells with resulting degeneration makes them subject to sudden spells of depression, crying, irritability, unreasonableness, impatience and temper, etc.

The Symptoms.—The patient may have a few minutes' warning—headache, dizziness, ringing in the ears, specks before the eyes,—but the attack usually occurs without warning.

"In the typical apoplectic attack the condition is as follows: There is deep unconsciousness; the patient can not be roused. The face is injected, sometimes cyanotic, or of an ashen-gray hue. The pupils vary; usually they are dilated, sometimes unequal, and always, in deep coma, inactive. If the hemorrhage be so located that it can irritate the nucleus of the third nerve the pupils are contracted (hemorrhages into the pons or ventricles). The respirations are slow, noisy, and accompanied with stertor. Sometimes the Cheyne-Stokes rhythm may be present.

The chest movements on the paralyzed side may be restricted, in rare instances on the opposite side. The cheeks are often blown out during expiration, with spluttering of the lips, the pulse is usually full, slow, and of increased tension. The temperature may be normal, but is often found subnormal, and, as in a case reported by Bastian, may sink below 95°. In cases of basal hemorrhages the temperature, on the other hand, may be high. The urine and feces are usually passed involuntarily. Convulsions are not common." (Osler.)

Apoplexy and acute alcoholism are frequently confused. The following table (Hare) differentiates them:

Alcoholism	*Apoplexy*
1. Pulse rapid, compressible and weak.	1. Pulse apt to be strong and slow.
2. Skin moist, or relaxed and cool.	2. Skin hot and dry.
3. Body temperature lowered.	3. Body temperature raised.
4. Pupils equally contracted or dilated; generally dilated.	4. Pupils unequal.
5. No hemiplegia.	5. Hemiplegia, one side moved, the other remaining motionless.
6. Breathing not so stertorous nor so one-sided in lips.	6. Respiration stertorous, the lips being inflated on one side on expiration.
7. No facial palsy.	7. Facial palsy.
8. Unconsciousness may not be complete.	8. Unconsciousness complete.

"The odor of alcohol in the breath is no guide, as acute alcoholism may have caused the rupture of a cerebral blood vessel."

The Treatment.—(Dr. Hare.)—The patient should be put to bed, in the recumbent position, with the head slightly elevated, the feet low. He should be kept absolutely quiet. An ice-cap or ice compresses should be applied to the head. Hot-water bottles should be applied around the body; a hot mustard foot bath may be given in some cases, to lessen the blood congestion in the head. Drastic cathartics are usually given to relieve cerebral engorgement. When vomiting occurs, the patient must be watched closely, as the stertorous breathing may draw in the half-ejected vomitus to the lungs. No stimulants are given.

Later, when bleeding is checked and there is no danger of further bleeding, potassium iodid is frequently given to cause absorption of the exudate. After all inflammation has subsided passive exercise, rubbing and massage are given to restore or prevent the wasting of the muscles of the extremities. Strychnin is also given to stimulate the spinal cord and reflexes, and to tone up the muscles.

The *diet* must be carefully selected. Meats are excluded or given sparingly; no wines are given as they tend to cause cerebral congestion and a second rupture.

The *bowels* must be kept open.

Venesection or bleeding has been extensively used in the treatment of apoplexy. Many doctors believe this treatment to be contraindicated, as it is now believed that the increased blood-pressure present in apoplexy is Nature's way of keeping up the circulation in the brain.

CHAPTER XXIX

NURSING IN THE PREVENTION AND CURE OF COMMUNICABLE DISEASES

The acute communicable diseases may be considered together as they have so many features in common that general principles may be laid down which may be applied in the care of all. Typhoid fever, pneumonia, and acute rheumatic fever, however, will be discussed separately. They are frequently treated in the general medical wards of hospitals, so, although typhoid fever is not as common as formerly, are apt to come within the experience of every nurse; they require the most expert care; the principles once learned in the care of patients suffering from these diseases, and the methods of treating and handling them—whether it be to insure comfort, or to relieve pain, fever and toxemia, or to prevent complications, or the spread of the disease, —may be applied equally well in the treatment and nursing care of all other communicable diseases.

General Principles to be Considered.—In addition to the four nursing principles already given in the beginning of our study, (see page 4), the treatment and nursing care in the acute communicable diseases are governed by the following important and common factors:

1. They are all contagious or communicable—some are also infectious. Diseases are said to be infectious when, in addition to being spread by more or less direct contact (contact short in time and space), they may be communicated or transmitted to others by organisms, such as the typhoid bacillus, capable of living outside the body for a considerable period of time, and of being carried over a considerable space without losing their power to cause disease.
2. They are all accompanied by fever.
3. They are all accompanied by more or less toxemia.
4. They are all apt to be accompanied by, or followed by, complications.
5. They are nearly all (with the exception of such diseases as meningitis, encephalitis, tuberculosis, and syphilis) said to "run their course"; that is, the *duration* of the disease is not greatly, if at all, altered by treatment; in some diseases, but not, as yet, in all, the severity, results, and the period of isolation may be altered by the use of vaccines and sera, as in the use of diphtheria antitoxin; but in all cases the *nursing care*, which keeps up

the patient's resistance, and helps him to put up a good fight, plays, perhaps, the most important rôle. It is frequently all that can be done for him.

6. They are said to be preventable diseases; that is, the *spread* of these diseases may be prevented by the proper care of the individual case, by proper sanitary provisions in the community, by instruction and proper hygienic living of individuals in the community, and by the proper use of vaccines and sera. In all this the actual nursing care, and the instruction given by the nurse, whether in the hospital, school, or in the homes of rich or poor, play an indispensable part in prevention and in the community health program.

Preventive Measures.—Nursing Measures to Prevent the Spread of the Disease.—When it is suspected that a patient is suffering from a communicable disease the first step taken by the doctor, and the first important factor to be considered in the nursing care, will be to *isolate the patient* and *apply medical asepsis*. A diagnosis should be made as soon as possible, and the patient must remain isolated until he is no longer a source of danger to others. The specific means taken to prevent the spread of the disease vary in degree and method according to the nature of the infection. It will depend upon:

1. The avenue by which the infective agent (organism or virus) enters the body.
2. The parts of the body affected and the avenues by which the infective agent is discharged from the body.
3. The period of communicability.
4. The means by which the disease or organisms may be transmitted, and the life history of the organism outside the body; and the factors of susceptibility and immunity.
5. The period of incubation, in so far as it relates to "contact" cases.
6. The seriousness of the disease, its duration, and complications which may accompany or follow it; and its degree of contagion or communicability in so far as these affect the activities of other members of the household, the quarantine and placarding of houses, and attendance at school or business.

It will depend, also, upon the sanitary measures provided in the community and upon the laws established by the Health Department of the city or state to control the spread of communicable diseases. Doctors, nurses, and student nurses should not only be familiar with these regulations, but should inform patients and other members of the community of the proper methods of observing them.

To *Isolate a Patient.*—Anything that has come in contact either directly or indirectly with the patient or infected area is contaminated and is, therefore, a means of spreading the disease. To isolate means to cut off completely any means whatever by which the infective agent may be transmitted, directly or indirectly, from the body of the patient to that of others; the organisms must be destroyed at their source, that is, upon discharge from the body. This is called *medical asepsis.*

In order to carry this out, it is thought desirable that the isolated room or ward should be, as far as possible, remote from others; communication between it and the rest of the house should be avoided or strictly safeguarded by proper methods of asepsis. In this respect, ideas as to the necessary precautions are undergoing change with the growing knowledge and understanding of the diseases themselves. The methods, therefore, of precaution are by no means uniform throughout the country. Formerly it was thought necessary to have separate hospitals, and a separate staff of nurses for communicable diseases; we still have such hospitals. At the same time, certain diseases such as pneumonia and typhoid fever, not considered highly communicable, and in which it was felt that the spread of the disease could be more easily controlled, were admitted, as a rule, to the general wards of the hospital and the patients were put on "special precautions." The nurses caring for these patients also cared for other patients in the ward not suffering from communicable diseases. This method is still customary in many and, perhaps, in most hospitals. But to-day we also find separate wards or a separate building connected with a general hospital provided for the care of all communicable diseases; and, in such cases, the care of these diseases—and this is highly desirable—forms part of the basic experience of every nurse.

The precautions taken between departments or services are also changing, and vary. For instance, two to six days must usually elapse before students caring for scarlet fever cases may be permitted to care for obstetrical or surgical cases; in some places three weeks are required by the Health Department. This is because of the danger of carrying the streptococcus organisms to such cases. During this period throat cultures are taken and symptoms of scarlet fever are carefully watched for; otherwise the medical asepsis carried out in the care of communicable diseases, and the general measures taken to guard the health of the students, are generally considered sufficient to permit nurses and others to mingle freely with other people.

The isolated room or ward should be large, well-ventilated, sunny, clean, and free from dust. There should be no unnecessary articles or furniture, and dusting should be done with a damp duster; a disinfectant solution such as bichlorid of mercury, 1:1,000, or carbolic acid, 1:40 may be used. The room should be screened from flies and other insects. Animal pets should not be allowed in the room and only such toys as may afterwards be destroyed or easily and effectively disinfected should be permitted.

The *"Unit" of Isolation.*—In a hospital, either each *individual patient* may be made the "unit," or the *disease* (two or more patients suffering from the same disease) may be made the "unit." When the *patient is the unit* all possible contact, direct or indirect, between him and any other patient will be completely blocked off; that is, if there are ten patients in a ward, whether suffering from the same or from different diseases, there must be ten units. A unit, strictly speaking, includes not only the area devoted to him but everything contaminated by him. Thus a student carrying a contaminated article from the geographical unit, such as a cubicle, is mentally within this isolated unit until she has disposed of the article and is herself no longer contaminated. This mental extension of the isolated unit is important. The unit area may be a space in an open ward, a cubicle, or a single room in a hospital or home. When in an open ward, screens, as a barrier, are sometimes used but are thought by some to be of questionable value if not actually a menace. There should be sufficient area (about 5 feet) allowed between beds to insure that cross infection cannot occur from the spray from nose or mouth which may travel three or four feet when coughing. Everything in a unit area, the floor in the whole building, and anything dropped on the floor are considered contaminated.

When the *disease is the unit,* two or more patients suffering from the same disease, from the standpoint of isolation, are considered as one; that is, the effort is not to protect or to isolate one patient from another; the doctor or nurse, for instance, wears the same gowns in going from patient to patient. There may be several disease units in the same ward; in that case the technique between units is the same as that given above when the patient is the unit.

In outlining the nursing care we shall here consider the *patient as the unit* of isolation for the following reasons: It is the best method of caring for the above mentioned patients placed on "special precautions" in a general ward, and is a method which may readily be adapted to any situation whether in a hospital, home, or community; it is being applied by some pediatricians in the pediatric wards to protect infants (all of whom are susceptible) from infections of the ears and upper respiratory tract: its principles form a large part of the basis of any health program and should be applied in the personal hygiene and health habits of any individual: it is the more modern method of caring for communicable diseases, and is considered by some physicians to be the only safe method, as the organisms causing the same disease, as in scarlet fever, and pneumonia, vary in type or strain, and in their virulence. This method is also in keeping with the important and fundamental principle of nursing which makes the needs of the individual patient the unit or center of thought, study, and care.

The *Physician and Nurse as Factors in Prevention.*—Each should guard his or her own health and build up bodily resistance by proper hygienic measures and health habits—the right kind of food, exercise, fresh air, rest and sleep; and should avoid worry, fatigue, exposure to cold, constipation, cuts, abrasions, scratches, "common" colds, or anything which tends to lower resistance and predisposes to the danger of contracting the disease. Any symptom of the disease, however mild, and any condition of the hands or arms which interferes with the necessary "scrubbing" should be reported at once. The nurse should at all times cultivate the habit of *not* putting her hands near her face, or of putting such articles as pens, pencils, or pins in her mouth. At all times she should guard herself from the spray when patients are coughing or sneezing, but particularly so when the germs are present in the secretions of the nose and mouth as in diphtheria, scarlet fever, colds, influenza, pneumonia, meningitis, pulmonary or laryngeal tuberculosis, measles, smallpox, whooping cough, mumps, poliomyelitis, and syphilis when lesions are in the nose, mouth, or throat. Any means of contact with such secretions as in kissing, or allowing patients, particularly children, to touch one's face should be avoided. The nurse should use a gargle and spray her own throat with a mild antiseptic both to protect herself and other people; the nurse, while she may escape the disease, may be, from close contact, a carrier. Strong irritating antiseptics should not be used as irritation of the mucous membrane predisposes to infection.

The protection of the *clothing* of the nurse and physician from contact with contaminated articles must be safeguarded. Ideas as to the precautions necessary are changing somewhat and are, therefore, varied. Formerly it was thought necessary, and it is still the custom in some hospitals, for nurses to change their uniform for a special garment, and to wear a special cap when caring for patients in an isolated ward or department; before leaving the department this garment was replaced by the uniform. To-day, while in some hospitals it is thought necessary, for various reasons, to continue this practice, it is thought by many to be unnecessary. Emphasis is placed upon the aseptic methods which prevent cross-infection, that is, the spread of infection from one patient to another in the ward or building which is sufficient to insure that infection will not be carried to others outside the building. In the latter hospitals a nurse or physician wears her or his own clothing; in some places a special cap is still worn, while in others the hair is closely confined but no special cap is worn: a gown is worn (fastened at the neck, crossed well over the back, with side tapes firmly tied so that the clothing is completely covered) in doing anything in which there is any possibility of contact of clothing with the patient or contaminated articles. This includes all treatments, all examinations, morning and evening care, feeding helpless patients, and taking the temperature, pulse, and respiration of children, helpless, delirious, restless, unintelligent, and uncoöperative patients. The sleeves of the nurse's uniform, to avoid contamination, are worn rolled above the elbow, and are usually allowed to remain rolled, in order to be in readiness, when in the isolated ward. The sleeves of the gown are securely fastened at the wrists; in some places elastic bands are used.

Putting on and removing a gown requires a special technique based on the principles of asepsis. It will depend, to a certain extent, also, upon the methods adopted in each hospital. For instance, in the Isolation Department of the New Haven Hospital a fresh, clean (sterilized), gown is put on for each treatment; a gown is worn only once; it is put on and removed at the bedside of the patient; it is rolled up, wrong side out, and carried to the hamper for contaminated gowns; the gowns, if unsoiled, are resterilized and worn again. The hands and arms of the nurse are scrubbed for two minutes after disposal of the gown in the hamper.

Usually, however, gowns for the nurse and physician remain in the patient's cubicle and, if unsoiled, are used repeatedly for that patient. In this case, the hands are scrubbed *before* removing the gown; the gown is carefully folded, clean side in, and hung up; the hands are again scrubbed. This method is, perhaps, harder on the hands but less so on the linen.

The hands, fingers, and nails require special care as they, perhaps, are the chief offenders in spreading disease. They should be in good condition—free from chafing, cuts, abrasions; the nails short and clean; scrubbed immediately after contact with patient or contaminated article before touching any part of self—body, handkerchief, clothing;—or any thing—doorknob, faucet, utensil; or before going to another patient, to meals, or to some other room, or portion of the building. Special precautions should be taken in regard to food as it is one of the chief means by which germs may be transmitted.

Teaching is one of the most important and far-reaching functions of the nurse in relation to these preventable diseases. Health habits, principles of personal hygiene, measures of prevention, the value of an early diagnosis, public health and sanitation, the value of vaccines and sera, the responsibility of parenthood and citizenship, and other social, economic, and community aspects of communicable diseases may be taught to patients and relatives. Such diseases, particularly tuberculosis, syphilis, and rheumatic fever, cause great economic loss which can be prevented only through widespread education.

Specific Precautions to be Taken by the Nurse and Others Exposed.—Preventive Inoculation.—Besides maintaining her general health and bodily resistance, a nurse owes it to herself and the community to avail herself of whatever means of acquiring an immunity to communicable diseases present medical knowledge makes available. By protecting herself she breaks a link in the transmission and thus protects others. Before exposing herself, her susceptibility to diphtheria should be tested by the Schick test, and to scarlet fever by the Dick test. If the Schick test is positive, diphtheria toxin-antitoxin or diphtheria toxoid should be given; if the Dick test is positive, the susceptible individual should be immunized by intradermal injections of scarlet fever toxin (hemolytic streptococcic vaccine). If a nurse has been directly exposed to diphtheria, antitoxin is given for immediate protection. In *typhoid fever, smallpox, and whooping cough,* it is unwise for a nurse to take charge of these diseases unless she has previously had them or has been immunized against them. Successful vaccination against smallpox, and previous injection of typhoid vaccine, are sufficient protection against them. It is said that the value of pertussis vaccine has not yet been fully demonstrated. While an attack of whooping cough might not be serious to a nurse, the duration of the disease is prolonged and would, therefore, completely interfere with her professional duties.

Contacts and Carriers.—These present many serious problems from the standpoint of preventing the spread of communicable diseases. They are frequently not detected, and, even when known, the problem of handling them is difficult. The measures differ with the disease—its degree of contagion, its seriousness, period of incubation, mode of transmission, and period of communicability.

All contact cases should be watched closely and examined daily during the incubation period. During this period (especially toward the end) those who have not had the disease should not mingle with others, especially children, who have not had it. In exposure to diphtheria and scarlet fever, nose and throat cultures should be taken of those who have been in contact in order to detect carriers or those who may be contracting the disease. The Schick test should be made and either active or passive immunization be attempted with diphtheria toxin-antitoxin, or with antitoxin. In scarlet fever contacts, a positive Dick test with a negative throat culture should be followed by the administration of scarlet fever toxin; if the nose and throat cultures are positive, scarlet fever antitoxin or serum from a convalescent patient is given to give passive immunity. This immunity is short, lasting, probably, only about three weeks. But if cases develop they are usually mild. All carriers, those who have virulent organisms in the nose or throat, should be isolated until cultures are negative. Diseases which are thought to be spread by carriers are diphtheria, scarlet fever, cerebro-spinal meningitis, poliomyelitis (organisms in the nose and throat), and typhoid fever by means of contaminated urine and stools. Contact cases should not handle food, particularly milk, to be used by others.

Visitors.—Except in unusual circumstances, or when the patient is dangerously ill, only the nurse and physician, or those necessary for the care of the patients, should be admitted to the sickroom. When visitors are permitted they should be carefully instructed; a gown, without sleeves, should completely cover their clothing; a chair covered with a clean sheet should be placed for them so that contact with the bed or table, etc., may be avoided. If ignorance, lack of understanding, an uncoöperative attitude, or emotional stress make a visitor untrustworthy, he or she should be under observation throughout the visit. The danger incurred, however, should not dull one's understanding and sensitiveness to the feelings of the visitor and patient.

Animal pets should not be allowed in the sickroom.

Precautions in the Sickroom.—Concurrent Disinfection.—Everything in the isolated unit, everything used by or for the patient, everything which has come directly or indirectly in contact with him is considered contaminated. All contaminated articles should be destroyed or disinfected immediately following contamination throughout the course of the disease; this is spoken of as concurrent disinfection and is the only safe method to adopt.

In the hospital, each patient, like other patients in the hospital, will have certain toilet articles of his own—a tray with comb, soap, toothbrush, toothpaste,—and in this case, also, a thermometer. Where proper means of concurrent disinfection are available such articles as bedpans, bathtubs, dishes, and articles used for treatments will be used in common and disinfected immediately after use. In the home all articles necessary for the patient will be isolated with him.

Disinfectants and Methods of Using:

1. *Cleanliness.*—This includes the body, and especially the hands, of the nurse, as well as that of the patient; the floor, furniture, and surroundings in general; the destruction and protection from flies and other insects; sunlight and good ventilation; the prompt removal of remnants of food, soiled dishes, sputum cups, basins, bedpans, and other utensils; the frequent change of bed-linen, and adequate protection of pillows, blankets, and mattresses from discharges; the prompt removal of waste such as waste cotton, gauze, throat sticks, dressings, etc., which may be kept in a heavy brown paper bag fastened to the rod of the table or to the mattress.

2. *Destruction by Burning.*—All waste, such as contained in the paper bag, sputum cups, remnants of food, paper towels, garbage, floor-sweepings, and articles of little value are destroyed by burning; an incinerator is a valuable aid for this purpose.

3. *Disinfection by Boiling and by Steam.*—All *utensils,* such as bedpans, bathtubs, basins, irrigating cans; and dishes, food trays, water pitchers, etc., should be boiled for 20 to 30 minutes in separate sterilizers or other containers. *Glassware.*—Glasses and drinking tubes should be boiled in a separate container to avoid breakage. *Soiled linen* and *clothing* not injured by boiling are best disinfected in this way. In the hospital, hampers of linen are usually collected and disinfected in the laundry. In the home, if it is necessary to remove contaminated articles to some other room for boiling, they should first be placed in receptacles containing a disinfectant solution. The nurse should be careful not to contaminate the cover or handles of receptacles in order that they may be handled safely by other people. Linen must be disinfected before sending to the laundry.

4. *Soap solution* (10 per cent.) applied with a brush, prefer-

ably with running water, removes germs mechanically; washing soda, an ounce to 3 gallons of soap solution, makes it more effective.

5. *Coal Tar Derivatives:* Cresol or lysol solution, 1:1,000; or carbolic acid solution, 1:40 (2½ per cent.) may be used for hands; and carbolic acid solution, 1:20 (5 per cent.) for dishes, utensils, brushes, clothing, and body discharges. Such articles as stethoscopes, ear specula, and instruments may be soaked in this solution, the duration being at least one hour. Articles such as flashlights, injured by soaking, may be handled with a clean towel and washed off with this solution. Cresol or lysol solution, 2 to 4 per cent. may be used for the same purposes. *Common salt* (12 to 14 ounces to the gallon) increases the effectiveness of the above solutions.

6. *Formalin* (40 per cent. solution of formaldehyde gas in water) is an excellent deodorant as well as a disinfectant. A 10 per cent. solution may be used for dishes, utensils, clothing, linen, and for all body discharges, using double the amount of solution to that of the discharge; stools and other material should be broken up so that the solution will come in contact with all parts. The duration should be at least one hour. Formalin is not corrosive.

7. *Chlorinated lime,* chlorid of lime, or "bleaching powder" in a 3 to 5 per cent. solution is used to disinfect body discharges; or in the dry state is sprinkled over stools. It should be kept in an air-tight container and in a glass receptacle until used. While very effective, its use is limited because of its corrosive and bleaching action; it should never be used for clothing, instruments, metal or enamel ware. Milk of lime, thoroughly mixed, is also used to disinfect stools; the proportion used should be double the volume of the stool which should be freely broken up and allowed to stand for two or more hours.

8. *Bichlorid of mercury,* mercuric chlorid or corrosive sublimate in a 1:1,000 solution (15 grains in a quart of water) may be used for a disinfecting hand solution and for other parts of the body. Its use is limited because of its corrosive action on metals and because it combines with protein in body discharges which renders it useless as a disinfectant; it is used for clothing, walls, floors, and furniture.

Care of Secretions and Body Discharges.—Too much emphasis cannot be placed upon the care of these; they are the vehicle by which germs are discharged from the body and conveyed to others, and are, therefore, the source of the infection. While care should be taken of all secretions and discharges in communicable diseases, special precautions must be taken of the secretions and discharges from the affected parts of the body, which are known to contain the organisms. For instance, special care should be taken of the following: The *secretions of the eyes* in gonorrheal ophthalmia, and probably in diseases of the upper respiratory tract such as diphtheria, and measles; the *secretions of the nose and mouth,* in diseases of the respiratory tract such as colds, sinusitis, tonsillitis, influenza, pneumonia, tuberculosis, diphtheria, scarlet fever, whooping cough, measles, mumps, smallpox, chickenpox, meningitis, poliomyelitis, and in syphilis involving the nose, mouth, or throat; the *discharges from the intestines and bladder* in typhoid fever, dysentery, tuberculosis of the kidney or intestines, infantile diarrhea, and intestinal parasites; the *vaginal discharge* in gonorrhea, and in vaginitis of children; *discharge from wounds;* and *discharge from the ears* following colds, scarlet fever, etc.

It is said that diseases spread by infected secretions from the nose or mouth are the most difficult to control or prevent. As previously stated, when caring for a disease in which the germ is present in the eyes, nose, mouth, or throat, the nurse should avoid the spray from the nose or mouth when the patient is coughing or sneezing, or even when talking or laughing. This spray, laden with organisms, may be scattered three or four feet. All such secretions should be received on small pieces of muslin or gauze (but large enough to avoid soiling the hands) which may be used only once and placed in a paper bag and later burned. Handkerchiefs which cannot be burned should not be used; and the patient should never be allowed to place soiled muslin or gauze under his pillow or elsewhere; he should be taught the danger of scattering the infectious material, and how to prevent this. It is in the daily care of patients, through emphasis on personal hygiene, that the nurse finds her best opportunity for teaching the principles and habits of health. Covered sputum cups, either metal or a paper cup in a metal container, are very convenient. The paper cups should be changed frequently and disposed of by burning; the metal container should be cleansed and disinfected daily. Dried secretions should never be allowed to remain either in or on the outside of cups. Metal cups should contain a good disinfectant solution equal in amount to the sputum; this should stand at least one hour before emptying; the cups should then be disinfected and cleansed.

All infected discharges from the intestines and bladder are disinfected before emptying. *Stools* should be broken up, covered with a good disinfectant using double the volume, thoroughly mixed with a stick, and allowed to stand covered and protected from flies for at least one hour. *Urine* should have an equal volume of disinfectant added, and allowed to stand one hour. The bedpan and urinal are then cleansed with running water, boiled for 20 to 30 minutes, and scrubbed.

Discharge of the Patient.—Before discharge the patient is usually wrapped in a clean sheet and taken to the bathroom and given a complete bath including a shampoo; after the bath he stands on a clean sheet and is dressed in clean clothing; articles worn on admission should not be worn unless thoroughly disinfected. In some places showers, instead of baths, are used. Sometimes the shampoo is omitted; sometimes the bath is omitted for the aged or very weak, and following pneumonia or scarlet fever when chilling and complications are feared.

Care of the Unit after Discharge of the Patient.—Terminal Disinfection.—All linen should be removed and, where provision is made for disinfection, sent in proper containers to the laundry; otherwise it should be first disinfected. Mattresses, pillows, and blankets should be exposed to sunlight and open air; some authorities advise disinfection by hot air, or steam under pressure, while others feel this to be unnecessary. Dishes, utensils, toilet trays, and contents, etc., should be sterilized. All waste, and inexpensive toys should be removed and burned. The floor should be mopped; and all furniture and walls to the molding washed with soap and water. All drawers or lockers should be emptied and pulled out to air; and the room or unit exposed to sunlight and fresh air for 12 to 24 hours.

Terminal disinfection is disinfection by fumigation with formaldehyde gas (or sulphur when the aim is to destroy insects) after the removal of the patient. While not so essential as concurrent disinfection (little reliance being placed upon it by some authorities), it is frequently practiced as an added precaution to insure that no organisms remain which might spread the disease. The room after fumigation should receive a thorough cleansing.

Fever or Pyrexia.—It is now thought that the elevated temperature is a protective, defensive reaction on the part of the body which enables it to combat the bacteria and their toxins. The fever is due to increased oxidation with heat production and diminished heat elimination. It is thought to be chiefly due to the fact that the heat-regulating centers for the time being set the body temperature at a higher level than normal, that is, they so regulate heat production and elimination as to maintain the body temperature at a point which best enables it to defend itself. If it is very high (hyperpyrexia) or prolonged, however, fever is not only harmful to the bacteria, but to the body cells and must therefore be reduced by appropriate treatment. It causes increased oxidation and actual destruction of body protein, not only interfering with the function of the cells but actually destroying them. Excessive or prolonged fever will cause marked emaciation, lowered resistance and prostration.

Toxemia.—Toxemia is present in a more or less marked degree in all infectious diseases. Toxins cause marked destruction of body proteins. They attack the vital centers in the brain, the vital organs, the muscles of the heart and other muscles through the body and the secreting glands. The secretion of saliva, gastric and intestinal juices, the urine, perspiration and other secretions are interfered with. The muscles of the heart may be poisoned so that the pulse becomes weak and rapid; the muscles of the arteries may lose their tone so that the blood-pressure is lowered and the heart further depressed; the muscles of the intestines may lose their tone resulting in distention; the muscles of the bladder may lose their tone, resulting in retention of urine. Loss of tone in the skeletal muscles results in great weakness. Tissue destruction causes marked emaciation so that the patient may become completely prostrated. The fever is usually an indication of the toxemia, but not always. A patient may have a high fever with little toxemia, or a relatively low temperature with a marked toxemia.

The clinical picture varies with the degree of fever and toxemia and the kind of toxins elaborated by the different bacteria so that in certain diseases the clinical picture is characteristic and diagnostic. For instance, the toxic pneumonia patient is wakeful, alert, keenly interested and anxious about his condition, although he may desire only to be let alone. He knows his condition is serious and watches your expression, trying to pierce your professional expression and manner in order to learn what the outlook may be. He may become wildly excitable and violently delirious. The toxic typhoid patient is wakeful, lies with his eyes open but seeing nothing and is disinterested in what goes on around him. He is usually dull and stupid. He feels comfortable, has no desires and no complaints. He may become violently delirious but as a rule is quiet, in a state of stupor with constant low mutterings and tremor and restless movements of the fingers, but seldom tries to get out of bed as the toxic pneumonia patient does.

In *cerebrospinal meningitis*, the early stage of the disease is characterized by a period of excitement, with headache, restlessness, irritability, hyperesthesia (the patient jumps and starts at the slightest sound), and delirium. This is followed by a period of depression, in which the patient is completely prostrated and in a state of coma.

In *diphtheria*, the fever and toxemia usually coincide with the extent and severity of the throat lesion but the prostration is sometimes out of all proportion to the severity of the local process in the throat and other febrile symptoms. In *scarlet fever*, the temperature is usually high, nervous symptoms and prostration may be marked. In *smallpox*, the temperature is usually high and delirium may be marked. Such diseases as mumps, whooping cough and chicken pox are not usually accompanied by a high fever or toxemia.

The *symptoms* to be relieved, which usually accompany fever and toxemia, are chilly sensations, headache, pains in the back, aching limbs, thirst, coated tongue, dry mouth and lips, a dry, hot skin, loss of appetite, nausea, vomiting, diarrhea or constipation, a rapid pulse, malaise and weakness. The nervous symptoms may be restlessness, excitement, irritability, insomnia, mental confusion, delirium, convulsions or apathy and stupor.

Complications Apt to Accompany or Follow Communicable Diseases.—The complications and sequelæ to be feared and the measures taken to prevent them depend upon the disease.

In *scarlet fever,* they are nephritis, otitis media, adenitis and pneumonia.

In *diphtheria,* they are bronchopneumonia, myocarditis, nephritis, asphyxia, paralysis of the soft palate, muscles of the pharynx or respiratory muscles and cardiac paralysis with heart failure which may occur when convalescence is almost complete.

In *measles,* the lowered resistance of the mucous membrane of the respiratory tract predisposes to infection by streptococci, staphylococci, pneumococci, tubercle bacilli and others. Bronchopneumonia, bronchitis, diphtheria, otitis media, adenitis, ulcerative stomatitis, conjunctivitis and tuberculosis may follow. The patient is rendered particularly susceptible to tuberculosis.

In *whooping cough,* bronchopneumonia, hemorrhages and convulsions are the most serious complications to be feared.

In *mumps,* orchitis may be a serious complication in boys after puberty.

In *influenza,* complications are very common and serious. The most common are otitis media, mastoiditis, pneumonia, tonsillitis, bronchitis, pleurisy, rhinitis and inflammation of the sinuses. Meningitis, neuritis, marked mental depression, melancholia and other psychoses may also follow.

In *poliomyelitis,* paralysis of the muscles of the extremities, trunk or diaphragm is to be feared.

In *meningitis* the complications and sequelæ to be feared are otitis media, deafness, blindness, paralysis, mental deterioration, epilepsy, arthritis, septic pneumonia, endocarditis and pyelitis.

The Nursing Care and Treatments to Relieve Fever and Toxemia and Prevent Complications.—The underlying principles in the treatment of all diseases accompanied by fever are the same.

The treatment includes (1) rest, (2) diet, (3) fresh air and general hygienic care, (4) local applications and hydrotherapy, (5) drugs, sera, vaccines.

Rest.—The destruction of body tissues, the crippled heart and blood vessels and the muscular weakness due to the fever and toxemia make rest of mind and body absolutely essential. The body tissues are putting up a tremendous fight against the infection and all its energy must be conserved for that purpose. Rest means rest in bed and freedom from all causes of discomfort and unnecessary exertion. It also means freedom from worry, excitement, irritability, insomnia or delirium, all of which cause restlessness and the loss of energy by strained and restless muscular movements. Visitors, conversation and anything involving mental effort should be excluded. Every extra breath or heart-beat, every unnecessary movement or strained, uncomfortable position means additional and inexcusable waste of valuable energy. The degree of rest required varies in the different diseases and with the severity of the attack. In those diseases in which fever and toxemia are marked or in which heart complications or nephritis are feared the need for rest is particularly great. For instance, in diphtheria absolute rest and quiet are essential on account of the extreme danger of heart-failure and nephritis. Every unnecessary demand on the heart increases the danger and all forms of muscular movements mean increased destruction of body tissues and increased protein ashes to be eliminated by the kidneys. The danger of heart-failure in diphtheria increases as convalescence approaches. The patient must lie flat on his back, with one pillow only, throughout the disease and convalescence. On no account should he be allowed to sit up. All causes of excitement and movements apt to increase the strain on the heart must be avoided. In diphtheria and in all severe toxic cases or when the heart is weakened, the patient should never be allowed to turn or feed himself or even to lift his head. A nurse should always find out from the doctor the amount of exertion or exercise the patient may be allowed. The degree of rest should be prescribed just as are the diet and drugs.

Diet.—Fever and toxemia have a very important bearing on the diet. The energy required to combat the disease infection, the necessity for maintaining an increased body temperature and the prevention of tissue destruction make the diet a very influential factor. In ordering the diet the physician is guided by the following principles: (1) The necessary energy and material to repair body tissues must be derived from the food. Otherwise the body will be forced to use its own tissues and this will result in emaciation, loss of strength and lowered resistance, which predisposes to secondary infections and other complications or to a prolonged convalescence. The destruction of body tissues also leads to the formation of toxic products which adds to the general toxemia. (2) It has been estimated that the average healthy man at rest requires 2300 calories to meet the daily needs, whereas a patient at rest, but with a high fever, requires 2800 to 3000 calories to meet the daily needs, prevent loss of body tissues and enable the body to combat the disease. This must be derived from protein, carbohydrates and fats. (3) The amount of protein allowed is barely sufficient to meet the body needs, that is, about 75 to 85 grams. Protein leaves a large amount of ashes to be eliminated and so increases the work of the liver and kidneys, which are already poisoned and overworked by the toxins. This increases the danger of nephritis. Proteins are not required to produce heat or the power to do work so that, as there is no provision for storage, only an amount sufficient to repair the wear and tear in the tissues is allowed. (4) Carbohydrates are not only the most easily digested foods and form the most efficient fuel to produce heat but they are great "protein sparers," preventing the wear and tear and destruction of body tissues. (5) Carbohydrates and fats are either stored in the body or are completely burned, leaving little waste (carbon dioxid and water) to be eliminated so do not add to the burden of the kidneys. (6) The loss of appetite, the poor digestion and digestive disturbances usually make it impossible to give the full caloric needs during the early stages of an acute fever. No effort is made, as a rule, to force the diet, particularly when the acute stage is of short duration. When the disease is prolonged, as in typhoid, or when complications prolong the disease efforts are made to increase the diet to meet the body needs in order to prevent emaciation and lowered resistance. In all cases, as soon as the appetite and digestion permit, the diet is gradually increased. Fluid diet only is usually given in the acute stage. *Water* should be given freely and at regular intervals whether the patient seems to want it or not. Orangeage, lemonade and imperial drink should be given in addition to water. They are grateful and refreshing and are a means of supplying water and sugar. Water helps to keep the mouth in good condition, relieves thirst, dilutes toxins, aids in their elimination, lessens the toxemia and the danger of nephritis.

The diet is therefore much the same in all fevers, with modifications to fit the individual case.

In diseases, such as *scarlet fever,* in which nephritis is apt to develop, special care is taken by limiting the protein so as not to overtax the kidneys. Milk is the basic diet (see nephritis) and the patient is encouraged to take water, orangeade, lemonade and imperial drink. In *diphtheria,* while the fever is usually not high, the destruction of tissues by toxins may be marked so that it is most essential to repair the loss by a nourishing diet. When pain, difficulty in swallowing or regurgitation of the food through the nose occur (due to the effect of the toxins on the nerves and paralysis of the soft palate and pharyngeal muscles) the food must be given by nasal gavage, by rectum or through a stomach tube. In *whooping cough,* feeding is sometimes a difficult problem owing to digestive disturbances and the fact that taking food may cause a paroxysm of coughing followed by vomiting. Food should never be given at a time when the paroxysm of coughing is likely to occur but should be given after the paroxysm as it is usually followed by a period in which breathing is more quiet and the stomach is at rest. No dry foods should be given or food likely to irritate or cause difficulty in swallowing. Small amounts only should be given and the patient should eat slowly. All forms of excitement should be avoided. Children with whooping cough are apt to be irritable because the nerves are particularly affected and trivial things may cause a severe paroxysm of coughing. Coughing and vomiting are in themselves exhausting. In a prolonged illness like whooping cough, the loss of food and lack of nourishment are a serious drain on the patient's strength. In *mumps,* acid food and drinks sometimes cause pain. When such is the case they should be avoided.

General Hygienic Care.—Plenty of *fresh air* is highly desirable in the treatment of all infectious diseases. Fresh air is particularly valuable in diseases such as measles, whooping cough and diphtheria, in which bronchopneumonia may be a serious and often fatal complication. At the same time the patient must be properly protected from drafts, exposure and chilling. In *whooping cough,* drafts, a slight chill, being placed in a cold bed, or getting uncovered, may bring on a severe paroxysm of coughing. Flannel should be worn next the body on account of the sweating, which often occurs with coughing. Special care should be taken in *scarlet fever* to avoid chilling on account of the extreme danger of nephritis. The patient should be kept in bed not only during the disease but also in convalescence as the danger of nephritis is increased toward convalescence. Care should be taken in the use of the bedpan and in all other treatments, to avoid exposure and chilling. A flannel nightgown is advisable. In *meningitis,* also, the patient is very sensitive to cold so should wear a flannel gown (unless flannel is irritating) and should have sufficient clothing to keep him warm.

Light, with direct sunlight if possible, is also highly desirable, but should be so regulated as to cause no discomfort to the patient. In *meningitis,* however, on account of the hyperesthesia and sensitiveness to noise and light, the room should be both quiet and dark. No visitors or excitement, no creaking of doors or windows, no jars or noise of any kind should be allowed. In *measles,* the patient's eyes are frequently very sensitive to light, which must be regulated to avoid annoyance or discomfort.

Care of the Skin.—Daily cleansing baths are essential for comfort and cleanliness and to stimulate the circulation and functions of the skin. Exposure and chilling must be avoided in all cases but particularly in scarlet fever and diphtheria, on account of the danger of nephritis and in meningitis on account of the sensitiveness to cold. In diseases accompanied by a skin eruption special care of the skin is necessary. In *scarlet fever* and *measles,* bran baths or baths containing bicarbonate of soda are frequently used to relieve itching and burning. Oiling the skin or soaking it in warm water softens and aids desquamation in scarlet fever. Picking and pulling at the skin should not be allowed as it is apt to injure the tissues. In a severe case of *chicken pox,* at the height of the eruption, the regular cleansing bath cannot be given on account of the danger of breaking and infecting the vesicles or injuring the tissues, with resulting permanent scarring. Severe itching is relieved by gently applying a solution of bicarbonate of soda 1 dram to a pint. The eruption should be kept as dry as possible by the use of sterile dusting powders. In *smallpox,* the care of the skin is one of the most important and difficult problems. At the height of the eruption, regular cleansing baths cannot be given. Sometimes the patient is immersed in a warm (95° F.) continuous bath of plain water or water containing bicarbonate of soda. Itching and burning may be relieved by cold compresses or hot compresses may give greater relief. Various applications are used to relieve itching and discomfort and to soften the pustules. These may be in the form of ointments or oily substances such as vaselin or sweet oil to which 3 per cent. to 5 per cent. carbolic is sometimes added. Carbolic relieves the itching. In all diseases accompanied by skin eruptions, scratching must be avoided. With children it is necessary to cover the hands or to apply splints so that they cannot bend the elbows or to secure the hands in such a way that they cannot scratch the face.

The Prevention of Bedsores.—The danger of bedsores is particularly great and special care is required when the fever, toxemia and emaciation are marked or when the nerves are involved as in meningitis and poliomyelitis or when the disease is prolonged.

Care of the Mouth, Nose, Throat, Eyes and Ears.—Special care of the eyes, nose and mouth is essential in all fevers not only for the patient's comfort but to lessen the toxemia and to avoid serious complications. In those diseases in which the secretions are increased and contain the organism extreme care is required also to prevent the spread of the disease. Pyogenic organisms are always prevalent in uncared for mouths and may cause ulcerative stomatitis, otitis media, adenitis, bronchitis and bronchopneumonia. In *diphtheria,* lack of care and the presence of a mixed infection greatly increase the toxemia and danger of bronchopneumonia, a complication frequently fatal. In *meningitis,* the presence of herpes and sordes and in *smallpox* the presence of the eruption in the eyes, nose and mouth demand extra care. An ointment, oil or vaselin may be applied to the lids to prevent them from sticking together or to prevent the formation of dried secretions. In all cases the mouth should be cleansed frequently. Mild antiseptic sprays are used to cleanse the nose. Cold cream or vaselin may be used to soften dried secretions. If nasal irrigations are ordered they should be given with extreme care to avoid causing otitis media. Sprays and irrigations are used for the throat. In *measles,* the eyes should be cleansed several times daily. In *diphtheria* and *infantile paralysis,* paralysis of the soft palate and muscles of the pharynx may occur and interfere with swallowing. If the mouth and throat are not properly cared for, infected secretions and particles of food may be carried into the lungs and cause septic or foreign body pneumonia. In all cases care must be taken in cleaning the nose, mouth or throat to avoid irritation or injury to the mucous membrane as this aggravates the condition and increases the danger of mixed infections.

In diseases of the *upper respiratory tract,* in all of which otitis media is a complication to be feared, the ears should be examined daily. Symptoms of pain, tenderness, irritability, a rise in temperature or a discharge should be noted and reported immediately.

Elimination by the Bowels and Kidneys.—In all infectious diseases, but particularly when the toxemia is marked, and when nephritis is feared as a complication, the elimination by the bowels and kidneys should be closely watched. The bowels should be kept open by the use of cathartics or enemata, if necessary. Retention of urine should be watched for and treated if present. To avoid nephritis, the urine should be examined for albumin daily, both during the disease and convalescence.

Relief of Annoying Symptoms and Discomforts.—Fever, when necessary, is relieved by cold sponge baths, packs or baths and by the use of the coal tar products, acetanilid, antipyrin and phenacetin.

Headache is relieved by the reduction of fever, by the relief of toxemia, by cold baths or packs and by the application of an ice-bag or ice compresses.

Racking pains in the back and aching limbs are also relieved by acetanilid, antipyrin and phenacetin. The extreme *hyperesthesia, pain* and *sensitiveness* of muscles and limbs to pressure or handling which occurs in *meningitis* and *poliomyelitis,* demand extreme care in moving, turning or lifting the patient. Special attention must be given to the sensitive spine. The stiff muscles of the neck and back, with the head thrown back and the back curved, indicate that the body is trying to keep the part absolutely at rest, and the spine protected so as to avoid irritation and pain. Particular care should be taken when lifting the head and in the arrangement of pillows. The body and sensitive parts should be put completely at rest and all forms of irritation, pressure or discomfort removed. A cradle may be used to keep the weight of bedclothes from a sensitive limb or a splint may be applied to keep it at rest.

As in all conditions where it is necessary to lift the bedclothes from the body by the use of a cradle, means should be taken to keep the parts from becoming chilled. The extreme hyperesthesia, pain, and sensitiveness to cold in meningitis and poliomyelitis make extra care necessary. An electric light may be suspended from the cradle. Heat is one of the best means of relieving pain. Local applications of dry or moist heat may be used for sensitive parts. The position should be changed from time to time.

Irritability, restlessness, insomnia, and *delirium* are relieved by cold baths or warm sedative baths, by the application of an ice-coil to the head and by sedative drugs such as bromids or codein. For wild delirium morphin may be necessary to relieve restlessness and sleeplessness.

Coughing is relieved by steam inhalations, by the application of counterirritants to the chest and by the use of sedative drugs such as codein and heroin.

Digestive disturbances such as loss of appetite, nausea and vomiting are treated chiefly by a careful regulation of the diet.

Thirst is relieved by careful attention to the mouth and by giving plenty of water, orangeade or lemonade, etc., to drink.

The *sore throat* in scarlet fever and diphtheria is relieved by hot or cold applications to the neck and by the use of steam inhalations, sprays and throat irrigations. When dyspnea is very severe an intubation or tracheotomy will be necessary to prevent asphyxiation.

For *symptoms of heart failure,* heart stimulants such as caffein, camphor, adrenalin, and digitalis are used. Cold fresh air treatment is also valuable.

Specific Treatment.—In *diphtheria,* diphtheria antitoxin is used as an antidote, that is, to give a passive immunity to diphtheria.

The immunizing effect of diphtheria antitoxin takes place in a few hours and continues for an average period of about two weeks. It is of value, therefore, when an immediate protection is demanded as when a susceptible individual or one whose susceptibility has not been tested, is exposed to diphtheria. In the treatment of diphtheria, large doses, given early, will in most cases effect a cure. The antitoxin checks the spread of the membrane, softens and loosens it, reduces the swelling and improves the general condition. The breathing and pulse are improved, the temperature is lowered and other toxic symptoms subside. Disagreeable results sometimes follow several days after the injection of antitoxin. These consist in a rash which may be accompanied by pains in the joints, an elevated temperature and swollen glands. They disappear in two or three days usually.

The amount of antitoxin and the method of giving vary with the age and weight of the individual and with the severity of the attack. In infants, the dose varies from 2000 units in mild cases to 10,000 units in malignant cases. In adults, the dose varies from 3000 units in mild cases to 40,000 units in malignant cases.

The antitoxin should be warmed to body temperature and given very gradually into an area where there is an abundance of subcutaneous cellular tissue such as the abdomen or infrascapular region. The skin should be sterilized, the syringe and needle should be sterile.

Injections should be made as follows:

In mild cases —subcutaneous or intramuscular
In moderate cases—intramuscular or subcutaneous
In severe cases —intramuscular, subcutaneous, intravenous
In malignant cases—intravenous or intramuscular

When given intravenously one-half the usual dosage is given.

It is better not to employ massage over the point of injection.[1]

In *cerebrospinal meningitis,* lumbar punctures are performed as an aid to diagnosis, to relieve pressure due to increased fluid and exudate, and for the purpose of injecting antimeningitis serum.

The *antimeningitis serum* is a specific immune serum of therapeutic value only in meningococcic meningitis. If given early, it is capable of reducing the mortality rate 60 per cent. and of lessening the tendency to serious after-effects such as blindness, deafness, paralysis and deformities, in those that recover.

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[1] Health Department, New York City.

It checks the inflammatory process, stimulates phagocytosis, checks the growth of the meningococcus and causes the turbid cerebrospinal fluid to become clear.

Administration.—Following a lumbar puncture, by which the canal is drained (that is, the fluid is allowed to flow very gradually until the pressure is so reduced that only 3-4 drops come per minute), an amount of antimeningitis serum, a little less than the amount of fluid withdrawn, is injected subdurally. The serum is first warmed to body temperature and then injected very slowly under the least possible pressure. If these precautions are observed abnormal changes in the blood-pressure may be avoided.[1]

Watch the patient for the slightest change in pulse and respiration.

Injecting too much serum or injecting it too quickly may cause the respirations to cease and the pulse to become very weak, rapid and thready during or immediately after the treatment. If the needle is still inserted, withdrawal of fluid may relieve the symptoms—if not, artificial respirations, adrenalin or other heart stimulants should be given.

The amount of cerebrospinal fluid (in an adult) usually withdrawn is about 25 c.c. and the amount of serum injected is usually a little less, about 20 c.c.

The number of injections varies with the severity of the disease and is continued—every 12 hours or every day—until the fluid is sterile. Usually 4-6 injections are necessary but as many as 15 or more may be required.

In *scarlet fever*, large doses of scarlet fever antitoxin (antistreptococcal serum), or serum from a convalescent patient are given as early as possible to check the toxemia. This is followed by a prompt disappearance of the rash, a drop in the temperature, and the prevention of complications. Sometimes a severe urticaria develops, due to serum reaction, and causes great discomfort. This usually disappears in a few days.

The antitoxin is usually administered intramuscularly. The amount varies from 3000 to 12,000 units with the age or size and condition of the patient. The patient's blood is tested for toxins at the time of the administration and again on the day following. If the toxins have not been neutralized, the dosage of antitoxin is repeated.

Scarlet fever antitoxin, used as a prophylactic, produces a short immunity, probably only about three weeks. It is said that there may be some disadvantage in its therapeutic use, owing to the fact that a lasting immunity is not insured. In recent studies made at Yale University School of Medicine, it has been pointed out that "as scarlatinal antitoxin serum, . . . rapidly neutralizes this circulating toxin and thereby removes the stimulus, which induces a permanent active immunity, it becomes possible that patients promptly cured by antitoxin may become susceptible again, after the relatively transient passive immunity conferred by the administration of antitoxic serum has terminated." The possibility of a second attack should be remembered.

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[1] Health Department, New York City.

Convalescence from Communicable Diseases.—During convalescence, especially if the disease is prolonged, the patient requires careful nursing. Fresh air, sunlight, nourishing diet, the proper amount of exercise and freedom from worry, etc., are essential to enable the patient to regain his normal strength. Tonics are frequently prescribed. In some diseases the danger of complications continues throughout convalescence. These demand extra care. For instance, in *scarlet fever*, nephritis is more apt to develop toward or during convalescence. The urine should be examined daily for albumin, and all precautions used to prevent nephritis during the height of the disease should be continued. Convalescence in *diphtheria* is a very critical period because complications, which may prove fatal, may develop.

Paralysis may occur, particularly of the soft palate, pharyngeal or laryngeal muscles. This may occur at the end of the second week and makes feeding very difficult and demands great care. Paralysis of the soft palate causes food to regurgitate; of the pharyngeal muscles, causes choking and difficulty in swallowing; of the pharynx and larynx, causes secretions to accumulate, prevents their expulsion, and may allow food to enter the lungs and set up a foreign body pneumonia. If the mouth and throat are not clean the food will be infected and may cause septic pneumonia and abscesses. Careful cleansing, keeping the head turned to one side, slight elevation of the foot of the bed and aspiration of the throat will help to prevent this. Feeding by the stomach tube, by nasal gavage or by rectum may be necessary. The *respiratory muscles* may be paralyzed so that care must be taken to avoid conditions which in any way interfere with breathing, such as the condition of the nose and throat, the patient's position, weight of the bedclothes, or applications to the chest, gastrointestinal disturbances, or the ventilation, etc. These paralyses are temporary.

Cardiac paralyses and heart failure may occur in diphtheria during convalescence. Any sudden change in the pulse rate, either an increase or a decrease, is a very grave symptom. The heart failure may be due to the effect of the toxins or to paralysis of the pneumogastric nerve. This is especially apt to happen in those who have been very toxic and where paralysis of other nerves has occurred. Other symptoms of this alarming condition are pain, dyspnea, restlessness and vomiting.

During convalescence, therefore, especially in those who have been toxic, the slightest exertion or excitement, etc., must be avoided as even a slight exertion may prove fatal. Even in mild cases heart failure may occur. *Nephritis* may also occur. The urine should be examined daily. All predisposing causes should be avoided.

TYPHOID OR ENTERIC FEVER

Typhoid fever is an acute, general, specific, infectious, communicable disease with local lesions in the intestines.

Nursing Care and Treatment.—Dr. Osler has said that "careful nursing and a regulated diet are the essentials in a majority of cases," and that the disease can only be modified by placing the patient in the best possible mental and physical condition to withstand the invasion of the bacteria and their toxins. It is a disease in which attention to the little details is most important and brings the best results.

"That sufficient physical and mental rest and sleep are obtained, if possible," is the first important factor. "Real rest can be obtained only by careful and competent nursing."

There are several factors which make rest in typhoid fever essential. The battle is a prolonged siege, lasting from four to six weeks or longer; the temperature is continuously high and the toxins extremely poisonous, depressing the vital centers and causing marked destruction of tissues; insomnia is frequently present, the patient lying awake night and day (coma vigil). Typhoid is therefore very exhausting and leaves the patient an easy victim without resistance or strength to withstand a secondary infection or other complication. Every ounce of strength must be saved and he must be protected as far as possible from other forms of infection.

Rest means not only rest in bed, but in a comfortable bed, free from all sources of discomfort. The position must be comfortable, never strained, to avoid pain or other discomfort. The patient should never be allowed to sit up. The position should be changed frequently, but the patient should not be allowed to move himself. All exertion must be avoided in making the bed, giving a bath or other treatments, using the bedpan, and in feeding him, etc. Every movement is a waste of energy so everything should be done for him. Mental rest—freedom from care, anxiety, excitement and all mental demands, all of which cause fatigue—is essential. Nervousness and excitement during treatments, or due to forced diet, etc., must be avoided. No visitors should be allowed; the mental effort of listening to or keeping up a conversation causes an elevated temperature, a rapid pulse, restlessness, and wakefulness. Cold baths usually relieve nervousness, excitement and wakefulness; sometimes chloral, bromids or opium is necessary.

The *relief of annoying symptoms and discomforts* which sap the patient's vitality and often obscure the true state of the system is the next important factor.

The Ward or Room.—There should be plenty of air space with an abundance of *fresh air*. *Cold air* is best, as it has the same stimulating effect on the vital centers, the heart, lungs and metabolism, as cold baths. Care must be taken to avoid drafts, particularly when the body temperature is low. At the height of the fever drafts are not dangerous. The room should be as *quiet* as possible. In fever, especially in typhoid fever, noises of all kinds are very distressing. Avoid noise, excitement, disorder, commotion, visitors and unnecessary conversation; if necessary to speak, speak in a natural tone of voice. The amount of *light* is important; note whether irritating or not, and arrange to suit the patient. Light sometimes causes headache, nervousness and sleeplessness. In the toxic state the eyes are frequently kept wide open so are apt to become irritated. At night it is well to have a shaded light and the patient should be under close observation night and day; he is often quiet during the day and delirious at night. Patients sometimes desire a light at night. A room in a private home should have, as far as possible, all the characteristics of the hospital ward—large, well ventilated, proper lighting, free from unnecessary furnishings, quiet, systematic, orderly, no visitors and with proper facilities for the disposal of discharges, etc., and the care of linen. The *bed* must be clean, comfortable, dry, free from wrinkles, crumbs or any other source of discomfort or cause of bedsores. It must be well protected as the patient is apt to have involuntary movements. It must not be too warm and the clothes, particularly over the toes, must not be too tight—typhoid patients have poor circulation, and sometimes suffer from local neuritis with extremely tender toes.

The Patient.—He should have a daily cleansing bath and everything about him should be kept sweet and clean. His hands should be washed several times a day. A delirious patient is apt to contaminate his hands with fecal material and reinfect himself. It may be questioned whether a patient may reinfect himself or not. We do know, however, that one may have a second attack of typhoid fever, that a patient with typhoid fever may have a relapse or a second "flare-up," and that, to a body already struggling in a battle, the outcome of which is still doubtful, an increased number of organisms having an increased virulence would undoubtedly increase the hazards and demands upon the patient's resistance. More lesions may be formed in the intestines, just as one may have a number of boils, and a patient *with* typhoid fever has not yet developed an immunity. The position must be the constant recumbent, but should be changed frequently to avoid pneumonia and pressure sores.

Bedsores.—The marked emaciation, the destructive effect of the fever and toxins, the impaired metabolism, poor circulation, low blood-pressure (shown by the patient's dusky hue), the prolonged illness, and the profound involvement of nerve centers make even slight pressure a source of great danger. The patient may lose control over the bladder and rectum and this adds to the danger. The proper care of the skin, the cold sponge and cold tub-baths by stimulating the circulation and the functions of the skin aid greatly in preventing bedsores.

The care of the mouth and nose is extremely important. If neglected the mouth becomes dry, the tongue coated with a white, brown or brownish black fur and crusts form with cracks and fissures between which are extremely painful. Ulcerations may occur. The dryness is due to the fever, lack of fluid in the tissues, diminished saliva and to breathing through the mouth. It makes swallowing difficult and results in cracks and fissures. A neglected mouth may cause infection of the ears, tonsils, lungs, parotid glands, erysipelas, and the patient may reinfect himself with typhoid. It makes the patient uncomfortable, has a depressing mental effect, destroys the appetite, upsets the stomach and digestion. Parotitis may develop in the third week and is extremely serious.

The mouth must be kept clean and moist. It should be cleansed morning and evening and after each feeding. Care must be taken not to cause the patient to gag, also to avoid injury to the delicate mucous membrane. Cold cream should be applied to the lips and tongue half an hour before cleansing to soften a tender or badly coated tongue. Plenty of water to drink aids greatly in keeping the mouth in good condition. Bits of cracked ice to suck relieve the dryness and thirst.

Inflammation and increased secretions in the nose are common. The secretions become dried, forming crusts and scabs, and cause the patient great annoyance. The nose must be kept clean and the patient must not be allowed to pick at it. Cold cream should be used to soften and relieve irritation. Note any bleeding from the nose.

Headache is a common and most distressing symptom. It should be relieved by the application of an ice-cap or ice compresses to the head.

Backache and Aching Limbs.—The spine is frequently very tender and pains in the back and limbs may cause great suffering. Pillows should be arranged so as to support the back and keep the tender spine entirely free from the bed.

Sleeplessness is a most exhausting symptom. It is relieved by hydrotherapy, chloral, bromids, or morphin, etc.

Thirst is a constant source of discomfort. Even though the patient be too dull and toxic to ask for it, water should be given freely. One of the principles of treatment is to give water regularly and freely.

Coughing due to bronchitis is a common, irritating, and exhausting symptom which must be relieved.

Cold hands and feet, resulting from the low blood-pressure and poor circulation, are often a source of discomfort. A hot-water bottle should be applied.

Retention of urine often occurs and should be looked for. It results from loss of muscular tone in the bladder due to the toxins and is a cause of abdominal pain and discomfort. The bladder must be emptied by nursing measures used to relieve retention or by catheterization.

Abdominal pain, tenderness, and distention are distressing symptoms which must be particularly guarded against. They are due to the inflammation and ulceration of the intestines and to the loss of tone in the intestinal muscles. Distention may develop into the dreaded tympanites—dreaded because it predisposes to perforation and peritonitis and once developed is difficult or impossible to reduce. It is prevented by carefully regulating the diet, by giving plenty of water and preventing the accumulation of fermentation substances in the intestines by keeping the bowels open. Frequently a daily cleansing enema is given. The cold baths also help to prevent distention by improving the muscular tone of the intestines. Turning the patient also helps to prevent the accumulation of gas.

Maintaining vital resistance by proper feeding is the third important factor. The *diet* is an extremely difficult problem and doctors differ widely in what they consider safe for the patient. Some believe in a very *low diet,* almost starving the patient. This belief is based on the poor appetite, lessened secretions, the intestinal lesions and gastro-intestinal disturbances (such as diarrhea, constipation and distention), and the danger of hemorrhage and perforation. Others believe in giving a *high caloric diet*—"as much food as the patient will take and handle well." This varies with the patient, depending upon the appetite, gastro-intestinal disturbances, and toxemia. This second method is based on the facts already discussed in the effect of starvation, of fever and toxins on tissue destruction with resulting emaciation, loss of strength, and lowered resistance. Furuncles, bedsores and secondary infections are not so common when food is given. It is also based on the belief that, while in the early stages the loss of appetite and diminished secretion demand a limited diet, the body quickly recovers and can digest and assimilate food well. It is also based upon the fact that results by this method have been satisfactory. The high caloric diet is regulated by the following principles (Coleman):

1. That the minimum daily caloric requirement is 41 calories per kilo.
2. That the optimum daily caloric allowance is 60 to 80 or more calories per kilo, the average for a man weighing 150 pounds being 4000 calories.
3. That the minimum amount of protein should be given, sufficient to meet the body needs without taxing the tissues, the kidneys and other organs of elimination.
4. That fats should be given with care on account of the difficulty in digesting them and their tendency to cause diarrhea and other gastric disturbances.
5. That carbohydrates are the most efficient energy producers and are the great protein sparers.

The optimum daily protein allowance is 75 to 100 gm.

The daily carbohydrate allowance is 250 to 800 gm.

The daily fat allowance is 50 to 200 gm.

The basal diet consists of milk, cream, eggs (raw, soft-boiled, or soft-poached), milk-sugar, stale bread, or toast and butter. Milk substitutes and milk preparations are used—buttermilk, kumyss, cocoa, whey, junket, custard and ice cream, etc.; strained gruels, boiled rice or macaroni, baked potato, apple sauce and liquids, such as lemonade, orangeade, tea and meat broths, etc., are also included in a high caloric diet.

Whatever feeding is ordered by the doctor for the patient, the following principles must be observed by the nurse: All feedings must be given regularly and at stated intervals. The patient must never be forced but should be encouraged to take all the food allowed, the nurse remembering the importance of the diet in the patient's recovery. The fancies of the patient must be considered as far as possible; avoid things disliked, because they spoil the appetite and turn the patient against all nourishment. Note whether foods disagree or not; watch for a coated tongue, nausea, a sense of fullness, distention or diarrhea, and examine the stools for curds of milk and for undigested fat. Milk diluted with lime water or vichy is more easily digested—adding a pinch of salt also makes it more palatable and more easily digested. Give sweet milk very slowly, a teaspoonful at a time to prevent the formation of solid curds. When sweet milk is not taken well, buttermilk may be given. It is more easily digested, causes less nausea, distention, and diarrhea, because the fat is removed and the casein is finely divided owing to the lactic acid present and the mechanical action used in removing the cream or fat. Milk sugar is used instead of cane sugar because less sweet (sweet things are always nauseating to sick people and even healthy people with slight indigestion say that "the thought of sweet things makes them sick"), and because it ferments less easily. With many, however, it causes nausea, vomiting and distention; watch for this effect. Cold weak tea will often settle an irritated stomach. Meat broths have no caloric value and should not be considered as nourishment given, but they are tasty and improve the appetite. See that they are properly seasoned and varied as far as possible. They must not be given if diarrhea is present. Lemonade, orangeade and imperial drink are grateful and refreshing to the patient. They relieve thirst, stimulate the flow of saliva and improve the appetite and digestion. They are a means of supplying water and sugar to the tissues; they help to keep the mouth in good condition and have both a laxative and diuretic effect. *Water* should be given at regular intervals whether the patient seems to be thirsty or not. Two or three quarts and more, if possible, should be given daily.

When feeding the patient all exertion must be avoided. A glass drinking tube may be used, but if the patient is delirious or in a stuporous condition, he should be fed with a teaspoon. As a rule, patients are not awakened at night from a natural sleep for nourishment, but a dull, stuporous condition must never interfere with the regularity of the feedings.

Alcohol is used, by some doctors, in some cases. It stimulates the mucous lining of the stomach and aids digestion. It acts as a food, being burned, with the production of energy. It quiets and soothes the toxic, overstimulated nervous system, relieves nervous trembling, excitement, and sleeplessness, steadies and slows a rapid pulse, and causes the dry mouth and skin to become moist.

"The Elimination of Effete Materials by the Kidneys, Bowels and Skin."—Every avenue of escape must be kept open for the elimination of toxins and other waste products.

The *skin* is kept in good condition and elimination stimulated by giving plenty of water to drink, by cleansing baths, by cold sponge or tub baths, by alcohol rubs and massage and by general improvement of the circulation.

The *kidneys* are stimulated and flushed, the toxins are diluted and eliminated by giving large amounts of water, lemonade and imperial drink, etc. The kidneys are rested by giving a minimum protein diet and aiding elimination by the skin and intestines. Cold sponge and tub baths stimulate the kidneys and aid elimination.

Typhoid bacilli may be eliminated in large numbers in the urine, particularly if there is any interference with the proper flushing of the kidneys and in retention of urine. Urotropin is given as a urinary antiseptic. When retention of urine must be relieved by catheterization, extreme care must be taken to avoid infection, as the weakened bladder and lowered resistance make it very susceptible to infection by pathogenic organisms.

Proper *elimination from the bowels* is extremely important. The intestines is the seat of the local lesions. Improper care may result in hemorrhage, perforation, distention or tympanites which not only causes pain and discomfort, but interferes with the breathing and action of the heart, and the distended, weakened wall predisposes to hemorrhage and perforation. The patient should be watched for symptoms of distention and the stools watched for the presence of flatus, undigested food and blood. A daily cleansing enema is frequently given—care must be taken to avoid force or pressure and exertion or straining on the part of the patient. The enema should be small and not high. Great care must be taken in the use of the bedpan, also to avoid exertion. When lying down, the elevation of the hips on the bedpan always causes some strain and difficulty in movement, so that in some cases (when hemorrhage and perforation are particularly feared), even this slight exertion is not allowed. A large pad is used in place of the bedpan. The recumbent position is always maintained unless otherwise ordered. If tympanites develops it is treated by the insertion of a rectal tube, carminative enemata, the application of turpentine stupes to the abdomen and careful regulation of the diet.

The Relief of Toxemia.—Toxemia may be very severe, particularly in the second and third week, and may cause death. It is relieved by carefully regulating the diet, keeping up the resistance, giving plenty of water, aiding the elimination and by the use of cold air and cold tub or sponge baths. For the effect of the cold baths see the Brandt Bath, page 423.

Complications to be Guarded Against.—Typhoid fever is not feared so much for itself but for the complications which are apt to develop. Without complications the fever runs its course and the patient usually gets well. It is, therefore, important to know how to guard against such complications, to recognize their symptoms, and to know what to do should they develop. It is important to remember that the height of the fever and the severity of the attack have nothing to do with the danger of complications, as they are just as likely to occur with a light attack. Good nursing does, however, help in lessening the danger of complications.

The complications which may develop are a recrudescence or relapse, hemorrhage, perforation, cholecystitis, meningitis, phlebitis, thrombosis, pulmonary embolism, pneumonia, parotitis, otitis media, mastitis, bone lesions and arthritis.

The end of the second and during the third week is the most dangerous period, owing to the patient's weakened condition and lowered resistance. Necrosis, sloughing and ulceration of the intestinal lesions occur so that hemorrhage and perforation are particularly to be feared during this period. A sudden rise or fall in the temperature, or a sudden change in the pulse rate usually indicates complications. Chills may precede pleurisy, pneumonia, otitis media or parotitis, etc. Severe headache may indicate meningitis. The prognosis in hemorrhage or perforation is always very grave.

A *hemorrhage* usually comes without any warning. The *symptoms* are a sudden fall in the temperature, sometimes a sensation of sinking and at the same time or later, the appearance of blood in the stools. There may be pallor, cold extremities, clammy sweat, a rapid, thready pulse, restlessness and air-hunger. The *treatment* is to stop all food, keep the patient at absolute rest, moving him only when absolutely necessary, an ice-coil to the abdomen, and the administration of calcium lactate or an injection of horse serum or human serum to aid the clotting of blood. Morphin may be given to insure absolute rest of the patient and of the intestines. No bowel movements are allowed for two or three days and then with caution. When the loss of blood is so severe as to deprive the vital centers and the heart it should be treated like any other hemorrhage by elevation of the foot of the bed, heat to the extremities and transfusion, etc.

Perforation is even more dangerous than hemorrhage. The only hope for the patient is in its early recognition and immediate operation to close the perforation. It is due to ulceration or to distention with rupture of the weakened wall. It is most apt to occur in the third or fourth week. The symptoms are a sudden, sharp abdominal pain, a rapid rise in leucocytosis followed by the symptoms of general peritonitis—a rapid, thready pulse, rapid, shallow respirations, the temperature may fall, then rise, pallor, a pinched, anxious expression, cold, clammy sweat, persistent vomiting, local tenderness and rigidity.

The symptoms and treatment of other complications are the same as when the diseases occur alone.

Precautions to Prevent the Spread of the Disease.—The *nurse* should wear a gown and cap. Rubber gloves may be worn, if not, the nurse should carefully scrub and disinfect her hands after each treatment. When giving a tub bath a rubber apron should be worn. After waiting on the patient the nurse should avoid touching anything with her hands before disinfecting them, and should be particularly careful before going to meals and should avoid touching her face with her hands.

The *patient* should be covered with screens to protect from flies, both for his comfort and to prevent the flies from spreading the infection.

All the *utensils* to be used for the patient—dishes, tray, cutlery, bath tub, thermometer, bedpan, urinal, rectal tubes, etc.—should be carefully marked and isolated, when the patient is in a ward "on special precautions." They should always be disinfected after use.

All the *bed linen* and *gowns,* etc., used for the patient must be disinfected.

All *discharges* from the patient, the urine, stools, sputum, vomitus and bath water—must be disinfected. When the patient has involuntary movements, the nurse should be particularly careful in caring for the patient and in the disposal of the stool and linen, etc. Oakum pads are usually used under the patient. The nurse should wear rubber gloves throughout the procedure and in washing the linen even after it has been disinfected. (In many modern hospitals the disinfection and washing of the linen is attended to in the laundry.) The oakum pad with the stool should be securely wrapped in paper so that even rough handling in the garbage or sewage disposal will not scatter the stool and spread the infection.

After the disease is over the bed, mattress, blankets, linen and utensils, etc., should all be thoroughly disinfected.

Care of the Patient during Convalescence.—Convalescence usually begins in the fourth week, but the danger of heart failure and other complications must be constantly remembered. A recrudescence or relapse may occur in the fifth or sixth week. The diet is carefully regulated, eliminations promoted, and the pulse and temperature are carefully watched. All physical exertion and mental excitement are avoided until the temperature has been normal for at least a week. The same care regarding visitors, reading and conversation, etc., should be observed as during the disease. When the patient is finally allowed up he should be advised to move about slowly and avoid fatigue or mental excitement. Fresh air and sunlight are very important.

Typhoid Fever in Children.—The disease is much the same in children as in adults, only the lesions are less severe. Necrosis and ulceration of the intestinal lesions are not so common, or if they occur are not so deep so that hemorrhage and perforation are not so common. Tympanites is common, and, as in the adult, is a very serious condition. The fever is less regular, runs a less typical curve, is higher and of shorter duration than in the adult. The nervous symptoms are apt to be severe and constant.

The treatment and prophylaxis are the same as in the adult.

Tests used in Typhoid Fever.—*Examination of the Blood.*—*Blood cultures* are taken for the purpose of isolating the organism. The cultures are usually positive during the first week.

The *Widal test* is made to determine the presence of specific antibodies (agglutinins) in the blood. The test may be negative during the first week (when the blood culture is positive), but by the second week it is usually positive, while the blood culture may be negative.

A leucocyte count shows a leucopenia or decrease in the number of white blood corpuscles (usually from 3000 to 6000). There is an increase in the lymphocytes and a decrease in the polymorphonuclear cells. An increase in the polymorphonuclear cells points to a complication such as pneumonia, peritonitis, or phlebitis, etc.

Examination of the Urine.—The *Bacillus typhosus* may be found in the urine.

The *Diazo reaction* is a test used which indicates the presence of the organism in the urine.

Examination of the Stool.—Cultures of the feces show the presence of the bacillus in large numbers. They are most numerous during the second, third, and fourth weeks of the disease.

PNEUMONIA

Pneumonia is one of the diseases in which the nursing care is perhaps the most important factor. It must run its course, but skilled nursing care can do much to give comfort and prevent complications.

Pneumonia is an acute infection of the lungs and is the most fatal of all the acute diseases. It is called lobar or bronchopneumonia, according to the location of the pathological process in the lungs. The general principles of the treatment are the same in both conditions. In either case we have to consider a patient suffering from an acute infection and inflammatory process in the lungs, and from a marked general toxemia. The resulting consolidation and congestion of blood vessels not only interfere with the function of the lungs, but mechanically interfere with the action of the heart, throwing an increased burden upon it. The toxins of the disease also attack particularly the nervous system, the vital centers, the muscles of the heart and the blood vessels. The heart and blood vessels are both poisoned and overworked; the vital centers which control them are also poisoned, so that failure of the circulatory system is the great danger in pneumonia.

Bronchopneumonia is more apt to attack the weak, infants, and old people, in whom the power of heat production is very low. It is also more apt to be accompanied by acute bronchitis in which cold air may be irritating and may increase the cough. The treatment must be modified in these conditions. Cold air treatment may be too severe.

The *general principles in the nursing care* and *treatment* are much the same as in typhoid fever. *Rest* is absolutely essential. The patient must be spared every effort which means extra strain on the heart so that he may muster all his forces to combat the disease. Sudden movements are particularly to be avoided. He should be kept in the recumbent position with one pillow only, unless difficulty in breathing makes this position impossible. When in the semi-recumbent or sitting position he must be comfortably supported, prevented from sliding down and all causes of strain removed. He should be turned frequently, but never allowed to turn himself. Mental rest and quiet are equally essential; the patient knows he is ill, does not want to be disturbed, has enough on his mind, his attention being concentrated on the struggle to get enough air.

The General Hygienic Care.—The choice and management of the room or ward, the bed, care of the body, prevention of bedsores, and the care of the eyes, nose and mouth—are the same and equally essential with that in typhoid fever. The care of the nose, back of the nose and mouth is particularly important. Secretions must not be allowed to accumulate, as they interfere with breathing, are a source of discomfort and force the patient to breathe through his mouth. The mouth becomes dry, which adds to the thirst and loss of appetite, etc., and causes cracks and fissures to form. A neglected mouth, besides being a source of discomfort, is a real source of danger, resulting in sordes, fissures, interference with digestion and secondary infections such as otitis media, parotitis, bronchitis, lung infections and abscesses, etc.

The *diet* varies with the length of the disease and the degree of toxemia. In lobar pneumonia, the patient is usually very toxic. The appetite is poor, digestion is impaired, and the course is very short, so that no attempt is made to force the diet. Fluid diet is given. Milk or its substitutes are the chief foods. *Water* is given in abundance and lemonade, orangeade, and imperial drink for the same purpose as in typhoid. When lobar pneumonia is prolonged or when complications set in, also in bronchopneumonia, which is more prolonged, efforts are made to increase the caloric value of the diet.

The *elimination of waste materials* is extremely important on account of the absorption of waste products from the inflammatory process and the tissue destruction due to the fever and toxemia. Elimination by the skin, kidneys, lungs and intestines is stimulated by cleansing baths, cold air or cold baths, abundance of water to drink, and drugs which stimulate the circulation or promote the action of the skin, kidneys or intestines. Elimination from the intestines is extremely important on account of the great tendency to constipation and tympanites due to the toxic effect on the muscles of the intestines with stasis, fermentation and putrefaction. Tympanites interferes with the action of the diaphragm and adds greatly to the burden of the already distressed heart and lungs and favors congestion. It is prevented by cleansing enemata, by careful regulation of the diet with particular attention to the amount of fats and milk sugar. It is treated as in typhoid fever.

The *treatment for the relief of distressing symptoms* is directed toward the regulation of the local inflammatory process in the lungs and the general toxic effect on the nervous system, vital centers, heart and other organs.

The *symptoms* to be relieved are pain, cough, fever, headache, delirium, restlessness and sleeplessness, dyspnea, and cyanosis. The *complications* to be feared and treated if present are pleurisy (always present in lobar pneumonia), empyema, bronchitis, myocardial insufficiency, or vasomotor paralysis and pulmonary edema.

The *treatments* consist in the application of cold, of heat, and other counterirritants, rest, position, venesection and the administration of oxygen, antipneumococcus serum, and drugs.

Cold is applied in the form of *cold air*, the *cold chest compress*, an *ice cap*, and *cold baths*.

The Open-air Treatment.—The benefits of the open air—air which is dry, moving and variable in temperature, have already been explained in Chapter III. The reflex effect of cold, stimulating the nerve endings in the skin, and reflexly the vital centers controlling the heart, lungs, blood vessels and other organs, has also been explained. In pneumonia, in which a portion of the lung is completely incapacitated, the circulation interfered with so that the body cells are smothering for oxygen, and in which the vital centers, heart and other organs are poisoned by toxins, the beneficial effects of cold, open air are particularly valuable. The pulse becomes stronger and slower, the appetite is improved and cyanosis, headache, delirium, restlessness and sleeplessness are relieved. Only the face should be exposed. The patient should wear a hood and be carefully protected from winds and drafts. The extremities and body, particularly the shoulders, should be kept snug and warm and extra clothing and a hot-water bottle at the feet. If the body and extremities become chilled, the congestion and above symptoms will be increased. The patient is moved indoors for examinations, bathing, use of the bedpan and other treatments. A pneumonia patient should be closely watched constantly, and particularly when exposed to the cold air. A delirious patient may disturb the clothing and become chilled, or get out of bed or jump out of the window, or in some other way injure himself.

Cold air treatment, if used for infants, the old and weak, must be used with the greatest care because their powers of producing heat and of reacting to the cold are poor. Cold is not used in acute bronchitis, as the cold is irritating and increases the cough. Coughing is always very distressing and exhausting.

The *cold chest compress* may be used to relieve pain, and coughing due to pleurisy or bronchitis; to relieve congestion in the lungs, dyspnea and cyanosis and to act as a tonic to the heart. (See Chapter XXIV.)

An *ice-bag* may be applied to the chest to relieve pain due to pleurisy or to act as a tonic to the heart. It is not used for the very young or very old. It is also applied to the head for the relief of headache, sleeplessness and delirium.

Cold Baths.—The cold sponge or cold pack is used to reduce the fever when very high and prolonged, to relieve toxemia and restore the vital centers.

Heat sometimes gives more comfort and relief. Local applications are made to the chest in the form of the cautery, poultices or fomentations. Steam inhalations give great relief in coughing due to bronchitis. Warm sponge baths sometimes relieve restlessness and sleeplessness.

Other *counterirritants*—a mustard paste or dry cupping—are also used for the relief of pain, coughing and dyspnea.

Strapping the chest with adhesive rests the lung, prevents friction and relieves pain and cough due to pleurisy.

Venesection is sometimes performed to relieve cyanosis, and dyspnea in strong, full-blooded patients, when the livid, bloated face and full, bounding pulse indicate venous congestion. The cyanosis is due to the pulmonary congestion and obstruction with backward pressure on the right side of the heart and veins. The withdrawal of blood takes the burden from the heart and prevents dilatation.

Oxygen Therapy.—Oxygen, administered through a tube and funnel, or a nasal catheter, has long been used to give comfort and relieve dyspnea and cyanosis in pneumonia. While partially successful, such methods have obvious disadvantages to both patient and nurse, and are quite inadequate to meet the needs of the patient. By means of improved methods of administration, the oxygen concentration of the atmosphere breathed by the patient can now be controlled and accurately regulated as to dosage in accordance with his needs, and carbon dioxid, heat, and moisture can be removed. By maintaining an atmosphere with an oxygen concentration of from 30 to 60 per cent. (preferably 40 to 50 per cent.) the oxygen saturation of the patient's blood may be raised to approximately normal (95 per cent.), and the symptoms,—headache, irritability, rapid pulse, shallow respirations, delirium, nausea, vomiting, fatigue,—due to oxygen lack, may be relieved. The result is not only comfort, but increased resistance and prolonged life. The apparatus consists of a high pressure oxygen tank and tubing, with a gauge (by means of which the oxygen can be administered continuously and measured), and two metal containers through which the return air passes in the closed circuit before being breathed again by the patient. One container contains soda lime which, by chemical change, removes the carbon dioxid; the other contains ice by means of which the air is cooled and dried. Heat, moisture, and carbon dioxid are thus removed and an atmosphere of high oxygen concentration is administered. The cooler must be kept supplied with ice (filled about every two hours), and the soda lime tested by bubbling air from the system into a red phenolsulphonephthalein solution; it is changed if the solution turns yellow. The patient may be in a special chamber, or the bed may be partially or completely covered with a rubberized silk tent with windows through which the patient may be constantly observed, and openings which allow the patient to be fed, treatments given, and attention to all his needs with the minimum loss of oxygen concentration.

Drugs.—Codein or morphin are sometimes given to relieve pain and coughing. They are also given to relieve headache, delirium, sleeplessness and restlessness. Bromids, veronal, trional, and paraldehyd are also used for sleeplessness and restlessness—sleep is absolutely essential. Heart stimulants—caffein, camphor, strychnin, adrenalin—and respiratory stimulants—caffein, atropin, etc.—are given as required.

Antipneumococcus serum is used as the specific treatment in Group 1 pneumonia, and less successfully in the other groups.

Antipneumococcus Serum.—The pneumococcus, the cause of pneumonia, occurs in four types or groups, all first cousins, so to speak, in one large family, each giving rise to a different type of pneumonia—Group I, II, III, or IV pneumonia.

The diagnosis is made by an examination of the sputum and urine.

Type I pneumococcus causes about from one-half to one-third of all the cases of pneumonia and the mortality has been about 25 per cent.

Type II pneumococcus causes about the same number of cases with about the same mortality.

Type III pneumococcus causes about 10 per cent. of cases, and the mortality rate has been as high as 50 per cent.

Type IV pneumococcus causes about 20 per cent. of all cases of pneumonia and the mortality rate is about 12 per cent.

The antipneumococcus serum in Type I pneumonia is said to have reduced the mortality from 25 per cent. to 10 per cent. and is, therefore, of great therapeutic value.

The Method of Administration.—The serum is warmed to body temperature to prevent otherwise severe chills, and injected intravenously.

The average dose for an adult is 100 c.c., which may be repeated every twelve or every six to eight hours until the disease is checked.

The serum must be introduced very slowly and very gradually and the patient watched closely for any symptoms of unfavorable reaction such as sudden flushing of the face, restlessness and uneasiness, increased pulse rate, difficulty in breathing and urticaria with a possible serious collapse and fatal outcome.

If the case permits the delay, an hour or two preceding the intravenous injection, an intracutaneous injection is frequently given and the area watched for a local edema and erythema which indicate that the patient is sensitive and that special care must be taken in the use of the serum.

In many cases serum sickness—urticaria, edema of the skin, joint pains, enlarged glands and a rise in temperature—may follow a week or two after the injection.

The *crisis* in pneumonia, as the name suggests, is a very critical period due to the sudden drop in temperature, loss of heat, profuse perspiration and relief of strain on the heart. Marked depression and collapse may occur with a weak, rapid pulse, subnormal temperature, cyanosis, and cold, clammy sweat. The patient should be watched very closely when the crisis is due (which may be about the seventh or ninth day) and the nurse should help him through with careful nursing, by the application of external heat, by rubbing the extremities, etc., with warm alcohol to improve the peripheral circulation and by giving heart and respiratory stimulants as ordered.

Patients with an alcoholic history require particular watchfulness on the part of the nurse throughout the disease. They are more apt to suffer from heart failure and nervous symptoms and may develop delirium tremens. They are always thirsty and should be given abundance of water to drink. Water, nourishing diet, alcohol, and sedatives help to prevent extreme nervous symptoms.

During *convalescence* the patient must not be allowed to sit up or allowed any unusual exertion without special orders from the doctor because of the danger of sudden death from *failure of the weakened heart muscles.* When allowed to sit up the pulse must be closely watched. Sudden death from *pulmonary embolism* is also to be feared because during convalescence resolution is taking place.

Prevention and Prophylaxis.—Little progress has been made from the standpoint of the cure of pneumonia. Prevention is the best cure. The resistance of the body plays a most important part. All factors which lower resistance and predispose to pneumonia, such as exposure, faulty health habits, infection of mouth, nose, or throat, overcrowding and improper housing, should be avoided. Nurses in caring for pneumonia patients should take particular care of their own health. They should be well nourished, take the proper amount of exercise, and should avoid fatigue, exposure, mental worry, common colds or anything likely to lower their resistance. The nose and mouth should be cleansed with an antiseptic frequently. The presence of adenoids, hypertrophied tonsils, and other abnormalities predisposes to an attack. Care should be taken to avoid the excretions from the nose and throat when the patient is coughing or sneezing, also care should be observed when handling these secretions and sputum. When open-air treatment is used, the nurse should be warmly clad.

Pneumonia in Children.—Bronchopneumonia comprises 75 per cent. of all the pneumonia in the first year. It is always very serious, although the outlook is better than in adults. Lobar pneumonia comprises nearly all the cases of primary pneumonia.

The *nursing care* is much the same as in adults. When cold-air treatment is used, extreme care must be taken to protect from winds and drafts, and to see that the body and extremities are warm. Cold air is not used when bronchitis is present. When sponging young or feeble infants for fever, etc., extreme care should be taken to avoid exposure and chilling, as their powers of heat-production and of reaction are very poor. Frequent change of position is necessary; a young child may be held in the arms of the nurse. Circulatory failure is much less a cause for worry than in adults. Nervous symptoms—delirium, convulsions, meningismus (toxic irritation of the meninges) may be marked.

Tests Used in Pneumonia.—Examination of the blood shows an increased leucocytosis, increased polymorphonuclears, and, in the early stage, a positive blood culture.

Examination of the sputum shows the organisms present and the group to which the pneumococcus causing the disease belongs.

ACUTE RHEUMATIC FEVER

In the nursing care of acute rheumatic fever, we have to consider a patient suffering from an acute, local inflammatory process in the joints with excruciating pain, stiffness, and swelling and also from fever and general toxemia with pyrexia, thirst, loss of appetite, constipation, scanty, very acid urine and profuse sweats having a sour odor.

The *complications* to be feared are endocarditis, pericarditis, myocarditis, pneumonia, pleurisy, hyperpyrexia, and nervous complications—delirium, coma, stupor, prostration and chorea due to the concentration of the poisons on the nervous system.

The *room* selected should be sunny, cheerful and well ventilated. The *patient* should be protected from drafts and from changes in the temperature. He should wear a flannel gown, and if he perspires freely should lie between blankets to prevent chilling from the drenching sweats and to avoid the clammy, sticky feeling of wet sheets. The shoulders should be well protected. The gown should be open down the front and sleeves (if the arms are involved) to allow applications with the least amount of disturbance.

The *care of the skin* is extremely important on account of the sour odor and irritating quality of the acid sweats. The care of the buttocks is also important on account of the sweat and acid urine. Alkaline baths, alcohol rubs and keeping the skin dry with powder will keep the skin in good condition.

The *care of the mouth* is the same as in all fevers.

The *diet* and care regarding proper *elimination* are also much the same. When the salicylates are given, constipation is particularly to be avoided on account of the danger of acidosis.

Rest, not only of the painful extremity, but of both mind and body, is absolutely essential. Cardiac complications are to be feared with the mildest attack. All causes of restlessness and sleeplessness are to be avoided. The disease is acute and apt to be prolonged so that the patient needs all his energy.

The *relief* of pain is necessary to secure rest and sleep and if pain is not relieved, it will wear the patient out. Every movement may mean pain and even without movement the pain may be severe. Extreme care should be used in making the bed, in turning, lifting, or moving the patient, in the use of the bedpan, and in the application of treatments, etc. Avoid even touching or leaning on the bed unnecessarily—the patient will often scream with alarm at the mere thought. A cradle is used to support the weight of the bedclothes. Pain is relieved by *rest, position,* the local application of *heat, cold, counterirritation,* and by the use of *drugs.* Pain insures rest. The patient instinctively assumes the most comfortable position, that is, semiflexion of the joint, as this relieves the pull of the muscles on the tendons and ligaments around the joint. Rest and the proper position are obtained by the use of pillows, or a well-padded splint or cast. The danger is shortening of the tendons and ligaments resulting in a stiff joint. Moderate movement is sometimes encouraged to avoid this and extension with weights is sometimes used. *Heat* may be applied by simply wrapping the limb in lint, cotton or flannel bandages, or in the form of fomentations, the cautery, thermal light rays or antiphlogistin. Ultraviolet rays are also used. When applying heat, the joint should be protected from changes in temperature. *Cold* is applied in the form of an ice-bag, ice-coil or cold compresses. Various soothing lotions, such as lead and opium, or Fuller's lotion, etc., are frequently ordered. *Methyl salicylate* is applied as a rubefacient. *Cantharides* may be used in the form of the *fly blister.*

The *drugs* used chiefly to relieve pain are preparations of salicylic acid, which is antiseptic, antipyretic, and also anodyne. Commonly used preparations are sodium salicylate, aspirin, salicin and methyl salicylate. The salicylates lower the temperature, relieve pain and local inflammation and aid resolution. They may cause acidosis or marked symptoms of depression. A nurse should watch for their toxic effect indicated by buzzing, roaring in the ears, deafness, headache, skin eruptions, and gastric, cardiac, respiratory or cerebral disturbances. Drowsiness, dyspnea and vomiting point to acidosis. These drugs should be given well diluted. An alkali such as bicarbonate of soda is frequently given with the salicylates. It neutralizes the acid, prevents gastric disturbances, and acidosis, and is said to protect the heart. The nausea and pain, etc., are lessened if the drugs are given after the patient has had something to eat. Aspirin is practically insoluble in water or acids and so is said to pass through the stomach causing less irritation. Other drugs used to relieve pain and induce sleep are acetanilid, antipyrin, phenacetin (watch for their depressing effect on the heart with cyanosis and a weak, rapid pulse), veronal, morphin, and other sedatives.

Swelling with fluid in the joint is sometimes relieved by a tight flannel bandage and, if necessary, the withdrawal of fluid by paracentesis. Strict aseptic measures must be used to prevent infection of the joint.

Hyperpyrexia (104° to 105°) with restlessness, headache, and delirium is relieved by cold baths or packs.

If *chorea* is present the patient should have complete rest and isolation in a quiet, dark room and all causes of excitement should be avoided. Sedative baths or packs, chloral, bromids, morphin and arsenic are frequently given.

Acute Rheumatism in Children is said to be the cause of practically all the heart diseases. It differs from that in the adult in that the joint involvement is less severe, sweating is less profuse, but the heart suffers more. Chorea is also more common. Watch for twitching, fidgety, vague, jerky movements. The mental attitude is apt to be unstable so that the child is easily upset or excited and laughs or cries easily. Rest, quiet, and very careful nursing are essential.

PART II—B

NURSING IN THE PREVENTION AND CURE OF SURGICAL DISEASES

INTRODUCTORY

Opportunities for Serving and Learning.—Nursing in a surgical ward appeals to every nurse. It is a life of absorbing interest with a strong human and dramatic appeal, a life of action, a series of events in which tremendous issues (life or death) are at stake and in which the nurse plays an important part. The ward exists primarily for the preparation for, and the care of patients after undergoing an operation, and this responsibility belongs chiefly to the nurse. Every operation involves a considerable degree of risk and danger and requires a great deal of courage on the part of each patient which, in the rush of routine work, we often fail to appreciate or recognize—even those of us who shrink from and have difficulty in gaining sufficient courage to take a disagreeable dose of medicine. It is an experience which often brings the patient close to death. This we should remember when preparing the patient and taking him to the operating room as well as in the after-care and it should make us realize the seriousness of our responsibility toward him, for there is nothing more sacred than the life of another. The courage and cheerful or calm endurance with which most patients bear the sufferings following an operation are often heroic and to be able to do so much to relieve their sufferings and make them comfortable is one of the greatest satisfactions to every nurse. Their discomforts can nearly always be relieved by good nursing and this ability to get and see the results of one's work is most stimulating and inspiring. The feeling that one can do very little to help is often apt to be depressing. The character of the work itself is full of interest and satisfaction. The demand for alertness, coolness, resourcefulness, knowing what to do and how to do it with skill and without loss of time, and to be in the midst of deeds of courage, to witness bright, cheerful, or calm endurance of pain or difficulties call out and develop these characteristics in us.

It is because of the opportunity to develop, while serving, this special knowledge, special skills, special qualities of character, all so essential in nursing, that students are given experience in the care of patients in surgical wards.

The student's experience and duties consist in assisting the surgeon with examinations which aid in diagnosis, preparing the patient for operation, caring for him after the operation and in the prevention and treatment of complications which may develop, and also in caring for patients suffering from minor surgical conditions, accidents and emergencies.

As stated previously, surgical and nursing care do not end with the treatment of the local lesion, but aim at the complete restoration of the patient to health and to his social and economic status in the community. More and more attention is also being given to the *prevention* of gross pathologic changes such as cancer, ulcers of the stomach, toxic thyroid glands, diseases of the gall bladder, etc., through proper health teaching, periodic health examinations, the recognition of early symptoms and prompt treatment which prevents serious lesions necessitating a major surgical operation. The nurse plays an indispensable part in all the above aspects of both the prevention and cure of surgical diseases.

CHAPTER XXX

THE PREPARATION OF A PATIENT FOR A MAJOR OPERATION

THE EXAMINATION OF THE PATIENT

The examination of the patient previous to the operation usually includes the following:

A **physical examination** of the chest and part of the body affected, upon which the operation is to be made, always precedes an operation. In operations upon the pelvic organs, an examination of special organs, by means of the rectum or vagina, may be necessary. The examination of the chest is for the purpose of finding out the condition of the heart and lungs.

The condition of either the heart or lungs may contra-indicate an operation altogether or may determine the kind and method of anesthesia to be given, or may indicate that it would be advisable to delay the operation until the condition may be improved by medical treatment. A diseased heart would probably not stand the strain and shock of the operation and an inflammatory disease of any part of the respiratory tract, owing to the irritating effect of the inhaled ether, would probably develop into a very severe, possibly fatal pneumonia.

Exophthalmic goiter is another disease which frequently requires medical treatment until the condition is so improved that the operation may be carried out with safety. In this disease, also, special care is taken to partially or completely anesthetize the patient before going to the operating room and to "steal the gland" by not allowing him to suspect the possibility of an operation or at least to have any suspicion as to the time set for it.

Examination of the Urine.—When on an examination of the urine, *albumin* is found, indicating inflammation and an inability of the kidneys to function normally, the operation is usually delayed until this condition, by medical treatment, is relieved. The toxic effect of the ether and of other incomplete products of metabolism which the kidneys are forced to eliminate, together with the shock, loss of blood, exposure during the operation, and the lowered resistance of the patient, would probably so increase the irritation and work of the kidney as to cause an acute attack of nephritis. Complete suppression of waste and toxic products in the body might follow, resulting in uremic poisoning, and possibly, convulsions, coma and death.

When *sugar* is found in the urine, indicating that the patient is suffering from diabetes, the operation is delayed (if at all possible) until this condition is relieved.

When *acetone, diacetic* or *β-oxybutyric acid* (the acetone group) is found in the urine, it indicates that the patient is suffering from acidosis. The operation will be delayed until the condition has been relieved.

Examination of the Blood.—A *"blood-sugar"* test or an examination of the blood for sugar may be made. The normal amount of sugar in the blood is from 75 to 120 milligrams of sugar in 100 c.c. of blood. An increased amount indicates that the patient is suffering from diabetes. Sometimes the blood-sugar is increased without sugar appearing in the urine. The presence of sugar in the urine or the increased blood-sugar indicates faulty metabolism. If the operation were performed the increased amount of sugar in the blood would so interfere with the metabolism of the tissues that the wound might not heal. Increased sugar in the blood also causes arteriosclerosis and arteriosclerosis narrows the size of the blood vessels and even completely closes some of them so that the nutrition of the tissues is greatly interfered with. This is the cause of gangrene in diabetes. In diabetes, also, the resistance of the tissues is very low so that they are very susceptible to infection.

If by medical treatment the urine can be made sugar-free and the blood-sugar reduced, the operation may be performed with safety.

A *carbon dioxid test* or an examination of the blood to find the volume per cent. of carbon dioxid may be made. The per cent. of carbon dioxid is an indication of the alkalinity reserve in the blood plasma. When the percentage is below 50, it indicates that the patient is suffering from acidosis. When the percentage is as low as 20 per cent. the patient is approaching the stage of coma. Acidosis may occur alone or more frequently with diabetes. It indicates faulty metabolism, the incomplete oxidation of fats, resulting in an accumulation of fatty acids (diacetic acid, etc.), which are highly toxic and result in coma and death. The toxic effect of the ether may aggravate a mild form of acidosis into acute acidosis which might prove fatal. The condition may be relieved before the operation by medical treatment.

A blood examination may be made to determine the *hemoglobin percentage.* The normal hemoglobin is from 85 to 110 per cent. If low, it shows that the patient is anemic, the vitality low and his resistance poor. Such a patient is a poor surgical risk. An operation would still further lower his resistance so, when possible, will be delayed until the condition is improved.

A *white blood cell count* or a *total leucocyte and differential count* is usually made before an operation, particularly when it is necessary to determine whether the patient should be operated upon immediately, or not, that is, whether it is an "emergency" case or not. The total leucocyte count means the total number of white blood cells, which normally varies from 5000 to 10,000 per cubic millimeter of blood. A differential count means the percentage of the different types of white blood cells which make up the total. An increase in the total number of leucocytes is called "leucocytosis," and in a surgical condition, indicates inflammation and suppuration in some place in the body. The polymorphonuclear type of leucocyte (normally forming from 65 to 75 per cent.) would in this condition be the white cell increased. For instance, if an appendiceal abscess were suspected, a surgeon would probably operate immediately if the leucocyte count and percentage of polymorphonuclear cells were increased, in order to prevent a rupture of the abscess and spread of the infection to a general peritonitis.

A leucocyte count may be taken after an operation also. It should return to normal in a few days. If not, it may indicate that the wound has become infected, or that it is not draining properly, or that some complication has set in, such as peritonitis or pneumonia. If the count is lower than normal, it indicates that the patient's resistance is low.

The Clotting Time of the Blood.—Normally the blood clots in from two to eight minutes. In some diseases, hemophilia, leukemia, and diseases of the liver, gall bladder or ducts which cause a backward flow of bile into the blood, the blood may take much longer to clot so that during or after an operation the patient may lose a great deal of blood before the bleeding can be stopped. Again in certain operations on the liver, spleen, gall bladder, and kidneys, and in tonsillectomy, etc., there is always an increased danger of a hemorrhage. In the above conditions, if suspected, and before certain operations, it is particularly important to find out the clotting time of the patient's blood. If this is longer than normal, for several days before the operation the patient is usually given calcium lactate and either human or horse serum to aid in the clotting of the blood.

The Blood-Pressure.—The blood-pressure is measured because patients with a high blood-pressure or any circulatory disturbance do not stand the strain and shock of an operation well. Efforts are usually made to reduce it by medical treatment before an operation.

Preparation for a Physical Examination

In assisting the doctor with an examination, the duties of the nurse are to prepare the patient and the necessary articles, to assist the doctor, and to make the patient as comfortable as possible before, during, and after the examination.

In all examinations the following are the essential things to be considered:

Preparation of the Patient.—The patient's comfort, both mental and physical, is the nurse's first consideration. An examination is always a trying ordeal to the patient, particularly when a rectal or vaginal examination is necessary. It is made by a strange doctor, who is assisted by a strange nurse, and before the patient has had time to become adjusted to new surroundings. The uncertainty as to what the doctor is going to do and the fear of exposure add greatly to the patient's discomfort. This the nurse, by her manner and tact, her knowledge of the conditions and of what is required, together with her skill in preparing the patient, can do much to relieve. Nervousness interferes with a proper examination. It interferes with breathing, with the natural body position, and causes all the muscles of the body to contract. For all examinations it is necessary for the patient to be completely relaxed. The necessity for the examination should be explained to the patient. Her confidence should be gained, and she should be assured that no unnecessary exposure will be allowed. A woman should never be embarrassed by being left alone with the doctor. To avoid this the nurse should see that everything necessary is at hand. This is particularly important when a rectal or vaginal examination is to be made. The preparations should be made quietly, naturally, without any fuss or undue haste, which leaves the patient with the feeling of being only half prepared. On the other hand, if prepared too long ahead, the suspense of waiting is apt to add to the nervousness of the patient.

The **room** should be warm, as in all examinations some exposure is necessary. Cold and chilling cause the muscles to contract and make thorough relaxation impossible. It should be absolutely quiet so that the sounds heard in auscultation and percussion may be distinctly heard. A good light is necessary for thorough inspection.

The **upper bedclothes** should be turned back neatly and smoothly, and arranged so that no bulk or weight interferes with the examination or the patient's comfort. The patient, his gown and bedclothes, should be scrupulously clean. Nothing is more embarrassing than to turn down the clothing and find the patient, his gown or undersheet, soiled or stained. The part to be examined should be exposed only during the immediate examination. The top sheet may be used to cover the chest or an extremity, until the examiner is ready. A towel or a square of soft blanket may be used for this purpose. When the extremities are to be examined the clothing should be arranged so that one or both legs may be examined separately or together and without unnecessary exposure. When the abdomen is to be examined the top sheet, when turned down, should be tucked in firmly under the thighs so as to avoid displacement and exposure. The patient's gown should be turned back neatly to the waist and tucked in smoothly and neatly under the body. A blanket, if necessary, should cover the chest and the abdomen also until the examiner is ready. When the chest is to be examined it is usually necessary to remove the gown entirely in order to inspect thoroughly the chest development and movements in breathing and for auscultation and percussion. It should be folded neatly, kept warm, and replaced as soon as the examination is completed. During the examination the patient's shoulders and arms and the part not under immediate examination should be kept covered. The part should be covered during consultations. The clothing should always be replaced immediately after the examination is completed.

When an examination of the pelvic organs is to be made in which a rectal or vaginal and abdominal examination are necessary, the bulky upper bedclothes may be fanned down to the foot of the bed or if necessary they may be removed and replaced by a blanket and suitable draping.

When the examination is made on a special examining table, in addition to the blanket and draping the patient usually wears a gown, dressing gown, slippers and stockings (laparotomy stockings) which reach to the thighs. A foot stool and the assistance of the nurse are necessary in assisting the patient to get on the table.

The **position** of the patient depends upon the purpose of the examination and the part to be examined. The correct position is essential for an accurate thorough examination. This position should be made as comfortable and free from strain and effort on the part of the patient as possible. Complete relaxation is desirable. The following are the positions commonly used:

To *examine the anterior chest,* the doctor may prefer to have the patient lie flat on his back with arms lying loosely at the sides and one pillow only under the head, so as not to distort the position of the chest or interfere with breathing. When able, the patient may be requested to sit upright. He should be supported by the nurse if necessary, and his back, arms and shoulders protected from cold or exposure. When examining the sides the arms are held loosely above the head. In examination of the posterior chest the patient may be sitting up leaning forward, supported by the nurse, with his arms crossed in front or extended and resting on his knees. Pillows should be pressed snugly against the lower back for support. When unable to sit up the patient is turned on his side inclined toward the anterior chest and with arms loosely extended above the head.

During an examination of the chest, especially when the patient is asked to count, or cough, the nurse should direct the patient to turn his head aside. A towel should be held between the doctor and the patient, but this must not be allowed to interfere with the examination or the patient's breathing or comfort. In auscultation the doctor may listen directly to the chest sounds by placing his ear against the chest. An "auscultation towel" made of thin muslin is first placed over the chest. If this towel is removed and replaced on another area for auscultation be sure that the same side is placed next the patient. When the chest is hairy it may be necessary to moisten it with warm water in order to prevent the sounds heard with the stethoscope from being obscured by the friction of the stiff hairs against it.

For an *examination of the abdomen,* the patient should lie flat on his back with legs extended, arms lying loosely at the sides, and one flat pillow under the head.

In an *examination of the pelvic organs* preceding an operation frequently a digital rectal or vaginal examination is necessary in addition to the examination of the abdomen. Provision must be made so that both palpation of the abdomen and a vaginal examination may be made together. For this purpose special positions (and special draping) are necessary. The following positions are those most frequently used:

The Horizontal Recumbent Position.—In this position the patient lies flat on her back with legs together and extended or slightly flexed to relax the abdominal muscles. One pillow only is allowed under the head. The arms may be crossed on the chest or lie loosely at the side of the body.

The Dorsal Recumbent Position.—This position resembles the above except that the legs are slightly separated, the thighs are flexed upon the body, and the legs upon the thighs so that the soles of the feet rest upon the bed. If the patient is placed on a special examining table the feet rest on the extensions provided for them, and the patient's buttocks are brought to the extreme edge of the table. When there is no special table sometimes the patient is placed across the bed so that her buttocks are at the extreme edge of the mattress and her feet are supported on a stool or chair. A board may be placed under the mattress to make it firm and even. This position is the one usually used for vaginal inspection or digital examination. The surgeon usually stands on the patient's right in order to use his right hand for examination.

The Dorsal Elevated Position.—This position is the same as the above except that pillows are placed under the head and shoulders so as to further relax the abdominal muscles. This is sometimes necessary for a proper bimanual examination of the pelvic organs.

The Dorsal Lithotomy Position.—The word lithotomy comes from two Greek words, *lithos,* meaning stone, and *tome,* incision. The position was called lithotomy because used for the removal of stones from the bladder. This position is the same as the dorsal recumbent except that the legs are well separated and the thighs are acutely flexed on the abdomen and the legs on the thighs. The buttocks are brought to the extreme edge of the table or a little beyond. To maintain this position and further separate the legs upright rods with stirrups attached are fastened to the sides of the table, the legs are sharply flexed backward and each foot is passed to the outside of the rod and fastened in the stirrup. A pillow or sandbag is sometimes placed under the hips to elevate the pelvis. The sandbag is better as it gives a firm, unyielding support. When an examination is made with the patient in bed one or two nurses may be necessary to support the legs and hold the knees apart and immovable, or a folded sheet may be passed under the knees and fastened behind the shoulders. This position is used for cystoscopic examination of the bladder, for examinations of the perineum, vagina and cervix, and for digital examination of the pelvic organs through the vagina. It is also used for operations on the perineum, vagina, cervix, bladder, and rectum.

Sims' or Left Lateral-Prone Position.—In this position the patient lies on her left side obliquely across the bed or table. One small pillow is arranged under the head so that the patient's left cheek rests comfortably upon it. Her buttocks are brought to the edge of the mattress. Her left arm is then drawn behind her back and her body inclined forward so that she lies partly on her chest. Her right arm lies in front in a comfortably flexed position. The thighs are flexed, the right one more so than the left. The knees are also flexed, the right more so than the left, so that it crosses the left and rests on the bed. When in this position the orifice of the vagina is clearly visible and the pelvic viscera fall forward. Sometimes a pillow is placed under the hips or between the knees to further expose the vaginal orifice. This position is used for examinations and treatments of the cervix and vagina.

The Knee-chest or Genu-pectoral Position.—As the name implies, when in this position the patient rests on her knees and chest. The head is turned on one side with the cheek resting on a pillow. The arms should be extended, flexed at the elbows and resting on the bed so as to partially support the patient, or they may be clasped above her head. They are never allowed under her. The patient rests on her knees which are slightly separated. The legs are extended, the thighs being vertical and at right angles to them. A small pillow may be placed under the chest but the abdomen remains unsupported. The abdomen is not allowed to rest against the flexed thighs because the object of this position is to cause the pelvic organs to fall forward. It is used for examinations of the bladder, vagina or rectum and sometimes for rectal irrigations.

The Standing or Erect Position.—The patient usually stands with one foot resting on the floor and the other on a low stool or the round of a chair, the legs being separated as far as comfort will allow. One hand usually rests on the hip, while the other (corresponding to the foot which rests on the chair) rests on the back of the chair for support. This position is used chiefly in vaginal examinations to determine the presence or degree of a prolapsed uterus.

The Trendelenburg Position.—This position is not used in the ward for the purpose of examination. It is used in the operating room during operations on the pelvic organs in order to displace the intestines from the pelvis into the upper abdomen. A special table is necessary which can be adjusted so that the patient's head is low, her shoulders held by shoulder supports attached to the table, her body on an inclined plane and her knees flexed over the adjustable lower section of the table which is lowered. The legs are fastened to this lower section to further prevent the patient from slipping.

The **method of draping** the patient in the above positions differs somewhat in different hospitals but in all the following rules should be observed:

The draping should be arranged so as to avoid all unnecessary exposure but at the same time so as not to interfere with a thorough examination. It should be loosely arranged so as not to outline the patient's figure unnecessarily and to allow a change of position quickly, but it should be securely fastened in place so that the necessary movements of the patient will not displace it. Only the part to be examined should be exposed, and that only during the immediate examination. Sometimes no exposure is necessary. Provision must be made for examination of the abdomen simultaneously with the digital examination of the vagina. In some hospitals special sheets are provided for draping. Otherwise two or more sheets will be necessary usually. Laparotomy stockings are also used. As stated previously provision must be made for keeping the patient warm. A screen is placed around the bed.

When preparing the patient for a vaginal examination see that the external genitals are scrupulously clean. Sometimes the examination is preceded by a vaginal douche but it is usually omitted for the first examination so that the doctor may see the nature of the discharge. The bladder and bowels should be emptied. The uterus is between the bladder and rectum so that its position is altered when these organs are distended. The purpose of the examination may be to detect malpositions of the uterus or the presence of growths, the signs of which are obscured by contents in the rectum or bladder. An enema may be necessary if the bowels have not moved within the preceding twenty-four hours.

The Articles Required for a Physical Examination.—For a vaginal examination the articles usually required are a pair of sterile gloves (the right glove only may be necessary), a sterile lubricant, a bivalve, Sims' or other variety of speculum and a uterine sound. If a local application is to be made or packing is to be removed or inserted in addition to the above the following articles will be required: uterine forceps, an applicator, absorbent cotton, sponges, a sponge holder, dressing forceps, tampons or a tube of gauze packing, scissors, the lotion to be applied and a basin for the packing or soiled instruments. All the instruments and other articles used must be sterile. The instruments used should be warm. A good light is always essential. Usually an artificial light and a head-mirror for the examiner are necessary.

PREPARATION OF THE PATIENT FOR OPERATION

The general mental and physical preparation has been discussed in Chapter XVIII. The preparation of the field of operation is a more advanced procedure requiring wider knowledge and skill. More experience in aseptic measures is required and an understanding of the parts which may be involved in the operation. The part is often very tender and painful, the patient is often nervous, restless, exhausted, and in a critical condition. It is important not to tire or alarm him so that gentleness, speed, sureness of touch, and skill are essential.

Preparation of the Field of Operation.—This preparation varies in different hospitals and also with different surgeons in the same hospital. The preparation used until within the last few years by all surgeons and which, in some cases, is still used by many is called a *wet antiseptic dressing* and consists of shaving, a thorough cleansing, with repeated or continuous disinfection of the part.

The morning before the operation the patient is given a full bath and the wound area, and as much of the surrounding area as is likely to be exposed on the table, are closely shaved. Shaving requires considerable skill in order not to cause pain and discomfort or to tire the patient out. First see that she is in as comfortable a position as possible, that the clothing is arranged to avoid unnecessary exposure both in order to avoid chilling and in consideration of the patient's feelings. Never attempt to shave without a good light. See that the razor is sharp and use a good lather. Be very gentle but hold the flesh firmly so that the skin is stretched, smooth and free from wrinkles or creases. Shave well between the folds. See that the whole area is shaved close and clean. Be very careful not to cause pain or to make abrasions which alarm the patient and cause discomfort. Work as quickly as possible so as not to tire the patient. Be extremely careful when the part is painful or the skin stretched and tender, as in peritonitis, or marked distention, or where there is local tenderness, as in appendicitis. Frequently the preparation is omitted until the patient is under the anesthetic.

This part of the preparation is an unsterile procedure. After its completion all the articles used are removed, cleansed and put away in their proper places. The razor must receive careful attention. It should be cleansed immediately. In cleansing wipe toward and not away from or over the blade so as not to injure it. Do not let it touch a hard surface. If necessary to disinfect it, cover it with alcohol. Never use bichlorid of mercury as it corrodes metal. The patient is then prepared for the sterile preparation or disinfection of the part. The necessary articles are brought to the bedside and the bedclothing, etc., arranged neatly and conveniently without unnecessary exposure. The nurse must either have an assistant to drape the patient, open packages, or bottles and pour solutions, etc., or must prepare them so that she can carry out the procedure without contaminating her own hands which must be kept sterile.

Preparation of the Hands.—When her preparations are completed, before proceeding with the sterile procedure the nurse must "scrub up." The hands and arms are scrubbed to the elbow with a brush, soap and running water for 5 minutes, paying particular attention to the nails and between the fingers. The nails should be short and cleansed with an orange stick. The hands and arms are then thoroughly rinsed, all the soap being removed with running water and are then immersed to the elbow in a disinfectant solution, usually bichlorid of mercury 1:2000 for 3 minutes. The soap must first be thoroughly removed, otherwise the bichlorid of mercury will combine with it forming a new compound having no disinfectant action on the skin. In washing or removing the hands from the disinfectant always allow the water to run from the hands down over the elbows and not from the elbows over the hands as the hands or fingers must come in contact with the sterile articles used. The hands may then be dried with a sterile towel or may be left moist. They must not come in contact with anything unsterile.

The area to be disinfected is then surrounded with sterile towels. It is then cleansed first with a sterile wipe saturated with tincture of green soap which is poured from the bottle by an assistant or by the nurse herself holding the bottle with a sterile wipe (the cork having been previously removed, the rim cleansed and covered with a sterile wipe). Throughout the procedure, in cleansing and disinfecting the part, the region where the incision is to be made should be cleansed first, always working from this point toward the circumference, and never touching the point of incision with a wipe used on another part, and, therefore, not sterile; germs must be carried away from, and not toward, the part. Solutions must be poured on a sterile wipe or sponge and never directly over the part—this is uncomfortable to the patient and wasteful. The soap is then washed off with hot sterile water, using the same precautions, then with ether to remove all the soap and other greasy substances. After this it is washed off with alcohol 70 per cent. and with another disinfectant, usually a hot solution of bichlorid of mercury 1:2000. The part is then covered with a dry sterile towel or frequently it is first covered with a sterile towel wrung out of a hot solution of bichlorid of mercury. The dressing is held in place by a binder or bandage securely fastened, to prevent it from slipping and so unsterilizing the part. For the same reason, the patient must be careful in moving about. This preparation is made about 12 hours before the operation. Sometimes the routine practice requires that the sterile preparation be repeated on the morning of the operation. Sometimes (especially when the part is dirty and requires special cleansing), after the first shaving and cleansing, a soap poultice, that is, gauze or a towel wrung out of a 12 per cent. hot solution of green soap, is applied and left on for several hours or over night and, on removal, the usual sterile preparation follows.

Another practice in use is the sterile preparation as described, but, six hours before the operation, the part is thoroughly dried with a sterile towel and painted with iodin 3.5 per cent. The iodin is allowed to dry and the part is covered with a dry sterile towel and binder or bandage.

Advantages and Disadvantages of the Wet Dressing.—The part is thoroughly cleansed and it is thought that the hot moist applications soften the skin and tissues, promote perspiration and bring the bacteria to the surface where they can be acted upon by the disinfectant. The disadvantages of this elaborate preparation are that it causes the patient considerable discomfort and inconvenience so that she is fatigued and the "fuss" is rather alarming. The softening of the tissues, and the lowering of the tone of the blood vessels lower their resistance, make them more susceptible to infection and the sodden condition causes them to heal less readily. It does not remove the bacteria as it is absolutely impossible to make the skin sterile. Some believe that it merely stirs them up and that the less they are disturbed the better, that it is better, so to speak, to "let sleeping dogs lie." The applications are difficult to keep in place and the whole preparation takes a great deal of a nurse's valuable time.

The Iodin Preparation.—Because of the disadvantage of the above method, because many surgeons consider it unnecessary, and because iodin is the best disinfectant, causing the least amount of irritation to the skin, most surgeons have adopted the following method. The part must be clean and shaved as closely as possible, and that is all until the patient goes to the operating room. The area is painted with iodin after the patient is on the operating table. Some surgeons require an application of iodin to be made in the ward. This is allowed to dry and is then covered with a dry sterile towel held in place with a binder or bandage securely fastened.

Precautions in the Use of Iodin.—In using iodin, it must be remembered that tincture of iodin is not a real tincture but merely a solution of iodin in alcohol, and that alcohol evaporates readily, so that if the iodin solution is not fresh or has been exposed to the air it becomes more concentrated, a stronger preparation which may burn the patient. Again iodin must never be applied to a moist surface nor moist towels, etc., be allowed to touch it after it is applied, because it will then surely cause a blister very difficult to heal. Its disinfectant effect is also interfered with. All perspiration or moisture of any kind must first be removed. Sometimes ether is first applied. It removes greasy substances, and, as it evaporates quickly, dries the part. Benzine is also sometimes used for the same purpose. Benzine is non-aqueous, evaporates, and dries the part. When applied, iodin must first be allowed to dry thoroughly before putting on the sterile towel. Avoid using too much as it is an irritant and will produce a burn. The skin should be a uniform light brown. The excess iodin may and should always be removed with alcohol, as iodin dissolves readily in it. Remove by mopping the part, never rub. After the operation the iodin should always be removed. In some hospitals it is removed with sponges saturated with starch water which combines chemically with the iodin, forming a new substance.

A very important point to remember when using iodin is that it acts differently on different patients. The tissues of some are very sensitive to it. I have known of two cases in which gangrene resulted from the use of iodin; in one, gangrene of the foot from an application for bunions, in the other, gangrene of the abdomen from iodin used as a preparation for an operation.

An Emergency Preparation.—When the patient must be taken to the operating room immediately or within a few hours after admission, no soap or water must be used on the skin in shaving or cleansing. A "dry" shave is given and the iodin (7 per cent.) is either applied in the ward or in the operating room, or in both.

Advantages of the Iodin Preparation.—The advantages of this preparation are that the patient is inconvenienced, worried, and fatigued to the least possible extent. Iodin is a powerful disinfectant. It penetrates more thoroughly than others, but is less irritating to the tissues, and if any should be absorbed, does no harm. It is also stimulating to the skin. The results of its use are entirely satisfactory as wound infections seldom occur.

A number of substitutes for tincture of iodin are now frequently used. Among these are a solution of *iodin in carbon tetrachlorid*, and a two per cent. solution of *mercurochrome*. These are said to cause less burning and irritation and to be equally good, if not better, as skin disinfectants. The latter solution used consists of 2 per cent. mercurochrome dissolved in distilled water, alcohol and acetone. The alcohol and acetone dissolve fat and skin débris and thus aid in the penetration and bactericidal action of the mercurochrome. They also cause rapid evaporation and drying of the skin. The color or stain shows to what extent the germicide has been applied. Mercurochrome is also used as a germicide for infected wounds and for irrigations of infected mucous membranes of the eyes, ears, nose, urethra, bladder or vagina.

CHAPTER XXXI

THE POST-OPERATIVE TREATMENT AND NURSING CARE OF PATIENTS

The **general care** of the patient has already been discussed in Chapter XVIII. Although the discomforts which are apt to follow—headache, backache, thirst, nausea, and vomiting, distention, restlessness, sleeplessness and retention of urine—can very often be relieved by the simpler nursing measures and treatments, such as the application of cold compresses, poultices, stupes, and enemeta, etc., frequently other measures are necessary.

Such treatments are colon irrigations, to relieve distention; a lavage, to relieve nausea, vomiting, or distention; a Murphy drip or proctoclysis, to relieve thirst; rectal feedings, to rest the stomach and supply nourishment to the body; catheterization of the bladder, to relieve retention of urine, and a bladder irrigation, if necessary, to relieve cystitis. These treatments will be discussed in the present chapter. They require more knowledge, experience, and skill than those already discussed, so are not usually entrusted to less experienced student nurses.

A Colon Irrigation or Enteroclysis

The word enteroclysis is derived from two Greek words; *enteron*, meaning intestine, and *klysis*, a washing out of stagnant or waste material.

In a colon irrigation a large amount of fluid is injected, sufficient to distend the entire colon. It is intended to reach the ileo-cecal valve.

Anatomical and Physiological Factors to be Considered in Giving the Treatment.—The large intestine begins at the ileo-cecal valve and extends to the anus, consisting of the cecum, the ascending colon (about 5 inches long), the hepatic flexure, the transverse colon (about 20 inches long), the splenic flexure, the descending colon (about 8½ inches long), the sigmoid colon, and the rectum. The colon surrounds or frames from right to left the small intestines and is closely associated with the liver and gall bladder, the stomach and spleen, while the ascending and descending colon are in front of the kidneys. A hot solution in the colon therefore acts as a local application of heat to the above organs. "An injection of this kind goes into the very heat-citadel of the body, and if too cold, as it often is, produces dangerous chilling of organs which are ordinarily especially protected from cold by the omental apron and intestines" (Hare).

The normal capacity of the colon in an adult is about nine pints. Its diameter decreases from above downward (from 3 inches in the cecum to 1½ inches at the sigmoid flexure) but it is capable of enormous dilatation if produced gradually.

The movements in the large intestine are (1) peristalsis, carrying the contents on toward the anus; (2) antiperistalsis or retroperistalsis, carrying the contents backward toward the ileo-cecal valve so that fluid injected into the rectum may be carried to the ileo-cecal valve but cannot pass beyond. Woolsey states that "when the cecum and colon are distended the flaps of the valve are pressed together, preventing regurgitation into the ileum." "In an ordinary high enema the valve renders impossible the passage of the fluid into the ileum, but if a high pressure is steadily continued the fluid may pass the valve, though probably not before peritoneal laceration and other damage to the large intestine have occurred." Therefore it is not safe to use force and "an ordinary high enema causes the emptying of the lower ileum by stimulating its peristalsis so that there is no need to try to force an enema beyond the valve."

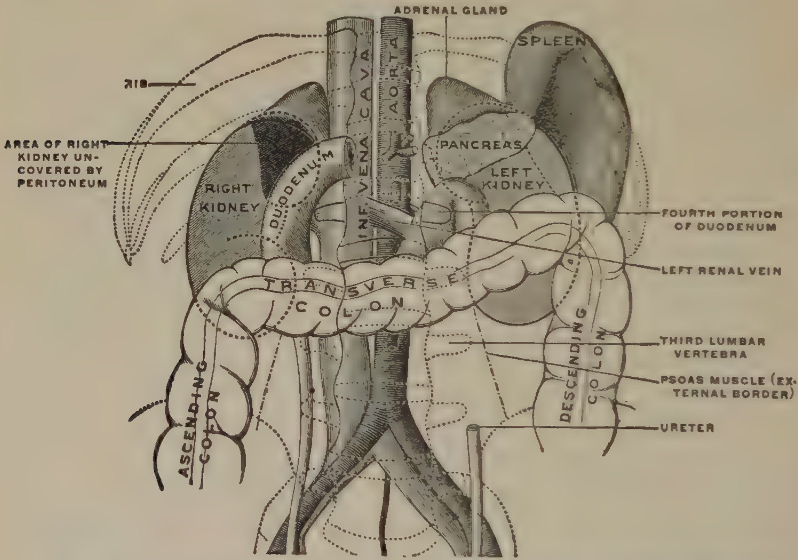
ADRENAL GLAND
SPLEEN
RIB
AREA OF RIGHT KIDNEY UNCOVERED BY PERITONEUM
RIGHT KIDNEY
DUODENUM
INF. VENA CAVA
AORTA
PANCREAS
LEFT KIDNEY
FOURTH PORTION OF DUODENUM
LEFT RENAL VEIN
TRANSVERSE COLON
THIRD LUMBAR VERTEBRA
PSOAS MUSCLE (EXTERNAL BORDER)
DESCENDING COLON
URETER
ASCENDING COLON

Fig. 129.—Showing Relation of the Colon to the Kidneys and Other Organs. Liver, stomach and small intestines have been removed. (Semi-diagrammatic.) (From Woolsey's "Applied Surgical Anatomy," Lea and Febiger, Publishers.)

The passage of the contents in the large intestine is slow, as may be seen in the accompanying illustration. Food begins to appear in the cecum 4½ hours after being swallowed; that is, it begins to leave the stomach ½ hour after being swallowed and passes through the small intestine (23½ feet) in about 4 hours. It takes about the same time (4 hours) to pass from the ileocecal valve to the splenic flexure, a distance of about 2 feet. In constipation and other diseased conditions the passage may be delayed causing marked dilatation of the whole colon with the production of gases and toxic products. There is considerable absorption normally in the large intestines, particularly in the cecum and ascending colon. The contents entering the cecum contain 90 per cent. water, while normal feces when passed are formed or semi-solid, so that large amounts of fluid may be absorbed when a colon irrigation is given, particularly if given under a slight pressure. In chronic constipation and other common pathological conditions affecting the intestine the toxic products formed are also being absorbed.

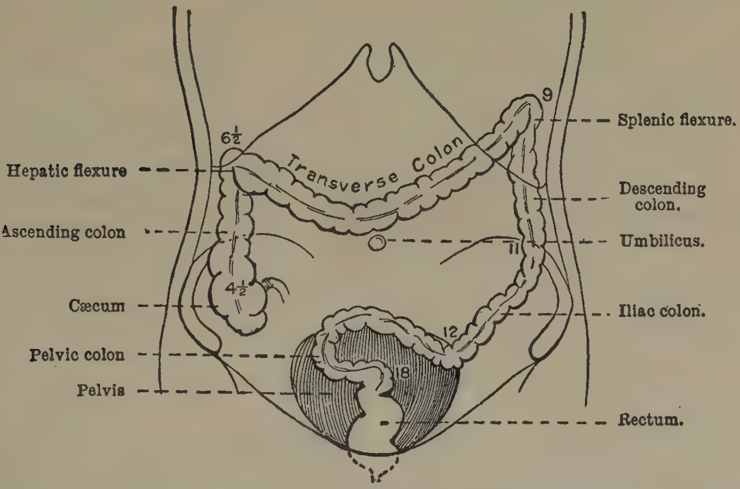

FIG. 130.—SEMI-DIAGRAMMATIC VIEW OF THE LARGE INTESTINE; THE FIGURES GIVE IN HOURS THE AVERAGE TIME AFTER TAKING A MEAL THAT ITS DÉBRIS REACHES THE VARIOUS PARTS. (Hertz.) This diagram shows the transverse colon in a higher position than it occupies when the man is erect, and rather higher than the average even in the horizontal position. (From Halliburton's "Handbook of Physiology," Blakiston and Son, Publishers.)

Conditions and Purposes for which Colon Irrigations are Given:

1. After operations for the following purposes:

(a) To thoroughly cleanse the large intestines of excess mucus, feces, toxic and putrefying matter. Colon irrigations are particularly valuable after operations on the alimentary tract or on the gall ducts, which interfere with the normal flow of the antiseptic bile into the intestines, resulting in the accumulation of toxins. They also relieve or prevent persistent vomiting which is often due to the accumulation of toxins in the body. Vomiting is very serious in all operations on the alimentary tract, gall bladder or ducts.

(b) To stimulate peristalsis and relieve flatulence.

(c) To supply heat as a stimulant in shock or collapse.

(d) To supply fluid to the body in order to increase the volume of blood, raise the blood-pressure and stimulate the heart; to relieve thirst; to supply fluid lost by vomiting, diarrhea, or hemorrhage; to dilute toxins in the body; to stimulate and flush the kidneys and relieve suppression.

2. In constipation.

3. In obstruction; the pressure must be low; the solution must be given slowly, the flow being constant, not jerky.

4. In dysentery, to cleanse from mucus and pus, and to dilute the toxins.

5. In inflammatory diseases of the lining of the large intestines, to supply local remedies such as tannic acid, boric acid, etc.

6. In inflammation of the kidneys and pelvic viscera.—A hot colon irrigation brings heat very close to the above organs. The heat directly stimulates the kidneys and relieves pain, congestion and suppression, and also relieves inflammation and pain in the pelvic viscera. The heat also stimulates the portal circulation, the liver and flow of bile.

7. In colic—hepatic, biliary, renal, or intestinal—to relax the muscles and relieve pain.

8. In toxemia and uremic poisoning, to dilute and help eliminate the poisons.

9. In poisoning from bichlorid of mercury, etc., in order to dilute and remove the poison from the intestines and body, to stimulate and flush the kidneys, and to prevent its destructive effect upon them and the resulting danger of acute nephritis and suppression, which might prove fatal.

The Important Factors to Consider in Giving the Treatment in Order to Get the Best Results:

(1) The *articles* required for the treatment will depend somewhat upon the method.

(a) *For the patient and bed.*—A blanket will be necessary to cover the patient; a towel and Kelly pad will be required to protect the bed and direct the return flow of the solution into the receptacle on the floor.

(b) *For the treatment* will be required an irrigating pole, irrigating can with tubing, clamp and connecting tip attached, a covered basin with two rectal tubes of suitable size, one larger than the other, vaselin for lubrication, a pail for the return, a large pitcher (2 gallon) with the solution and a basin of soap and water, sponges and towel for cleansing and drying the patient.

2. The *solution* used depends upon the purpose. It may be:

(a) Normal saline is usually used for cleansing. It removes the mucus, etc., and prevents loss of vital salts from the intestinal wall, and the absorption of water by osmosis, making the tissues boggy (Hare). Medications may be added to the solution, if desired.

(b) Plain water is used when the treatment is given to relieve thirst or to stimulate the kidneys or to supply fluid for any reason. Salts, whether given in the diet or by rectal injections, must be eliminated by the kidneys, if not needed by the tissues to maintain osmotic pressure. This will mean extra work for the kidneys and to an inflamed kidney also salts are very irritating. Again if the kidneys are diseased they will not eliminate salts from the body so that they remain in the tissues. The tissue cells cannot tolerate salts in their crystalline form so they draw water from the blood (osmosis) to dilute and render the salts less irritating, thus resulting in edema. When the kidneys are diseased, therefore, the patient is allowed only a "salt-free" diet and plain water rectal injections are given in order to give the kidneys less work to do, to dilute excess salts and other waste products in the body and render them less irritating to the kidneys.

(c) Potassium acetate (ʒ i to a pint) is frequently added for its diuretic effect.

3. The *temperature* of the solution is usually from 116 to 120° F., heat being one of the most valuable means of relieving pain, inflammation and congestion, and of stimulating the functions not only of the colon but of all those organs with which the colon is in contact, and of the body in general through its effect on the circulation.

4. The *amount* of solution used is usually from two to three gallons. When given for cleansing purposes the amount is determined by the result as the treatment is continued until the return is clear.

5. The *rectal tubes* used and the way in which they are inserted also depend upon the purpose. When used for cleansing purposes, the inlet tube should be smaller than the outlet tube (a catheter may be used) in order to allow for the return not only of the fluid but of the feces, flatus, and mucus, etc. The inlet tube should be inserted about 6 inches while the outlet tube is inserted about 3 or 3½ inches. Each tube should be marked with a narrow strip of adhesive plaster indicating when the tube has been inserted the desired distance and whether meant for the inlet or outlet of fluid. When inserted the adhesive marks on the tubes are opposite and just without the anus. If the injection is given to supply fluid, in order to have some of the fluid retained, the tubes should be about the same, or the outlet tube should be a little smaller than the inlet tube. For the comfort of the patient medium sized tubes only should be used.

Sometimes one rectal tube only is used which is connected to a T-shaped glass connecting tube. One arm of the glass connecting tube is attached to the inflow tubing which is attached to the irrigating can, the other arm, to the outflow tubing. Both the inflow and outflow tubing must then be provided with a clamp. A graduated glass irrigator should be used so that the amount of fluid entering the intestines may be estimated.

Position of the Patient.—Some prefer to give the treatment with the patient drawn to the side of the bed, in the left Sims' position, that is, on her left side with the knees flexed, the right slightly more than the left. In this position the fluid is carried by gravity into the sigmoid and descending colon and by anti-peristalsis may be carried to the ileo-cecal valve.

Others prefer the right Sims' position. When in this position, the solution is carried by gravity along the sigmoid and descending colon, and down the transverse colon to gradually collect in the ascending colon and cecum. Care should be taken not to use more water than is necessary and not to overdistend the bowel.

In obstinate intestinal obstruction, when irrigations with the patient in the above positions fail to bring about evacuations or relieve the condition, sometimes the *knee-chest position* is used (see knee-chest position, p. 557). The *advantages* of this position, in irrigating the colon, are that it allows the solution to run in easily by gravity so that it reaches all parts of the colon and removes threadworms, excess mucus or accumulated feces from the cecum and entire colon. The *disadvantages* are that it is very trying and apt to be exhausting, particularly to a patient already weakened by disease. In all cases the patient must be carefully supported by an assistant and the treatment given as gently and skillfully as possible.

If necessary, the treatment may be given with the patient lying on her back with the hips elevated. Whatever position is used must be made as comfortable as possible for the patient as the treatment lasts for a considerable time.

See that the patient is properly protected from chilling and from unnecessary exposure, that the bedclothes are neatly turned back, and the towel and Kelly pad placed under the patient to protect the bed, and so that the end of the pad hangs in a pail on the floor. The towel is placed under, not over the Kelly pad, so that when the wet pad is removed, the patient will rest on a warm, dry towel. This prevents the bed from being wet and the towel serves to dry the patient. The Kelly pad should be warmed before placing it under the patient.

Method of Procedure.—Hang the irrigating can about 3 feet above the bed; attach the tubing, clamp and inlet tube; pour the solution into the can; allow the solution to run through the tubing to expel the air and warm the tubing; then clamp it. Lubricate both the tubes and insert them both at the same time. This is easier and causes much less distress to the patient; when one is inserted the sphincter of the anus closes tightly on it, making it very difficult to insert the second tube. Sometimes the insertion of the two tubes together is made more easily if a hole is made in the side of the outflow tube into which the end of the inflow tube is inserted. They are thus inserted as one tube. After they are inserted to the mark on the inflow tube, both tubes are then adjusted so that each is inserted the desired distance as indicated by the markers on the tubes. The end of the outflow tube should be about a foot below the level of the patient in order to avoid too great suction. This would be apt to draw the mucous membrane into the holes in the outlet tube, and not only interfere with the return, but also injure the delicate membrane. If the outflow colon tube is not long enough to permit this it should be attached by a connecting tip to another piece of tubing. Also if this tubing does not extend to within about a foot of the pail on the floor when considerable gas is expelled, it will scatter the fluid and fecal matter, soiling the bed, etc. When the distance from the pail is too great, the noise and splashing are also objectionable. Inject the solution slowly so as not to excite the bowel to contraction. This allows the desired amount to be given and secures the desired effect—thorough cleansing or retention, etc. Very little force should be used.

If the patient complains of abdominal pain, clamp the inlet tube for a few seconds and note whether flatus is expelled or not—pain is frequently due to the contraction of the muscles in the effort to expel the gas. If the pain is continuous, stop the treatment. If properly given there is usually no pain. If there is difficulty in obtaining the return, move the outlet tube up or down. It may be necessary to remove and cleanse it. Stop the treatment if the patient shows signs of exhaustion.

When the desired effect has been attained remove the tubes gently; cleanse the patient; remove the Kelly pad and dry the parts. If the parts are irritated a soothing ointment should be applied.

Chart the amount of solution used, the amount retained and the results—whether there was much fecal matter, odor, flatus or mucus, etc., in the return and whether the treatment caused pain or not.

A Proctoclysis, Rectal Infusion or Seepage

The word proctoclysis comes from two Greek words; procto comes from *proktos* which means anus or rectum; clysis from the Greek *klysis,* a washing out of stagnant or waste materials in any cavity. The treatment is commonly called the "Murphy drip" after the noted surgeon who first used and described it.

The **purposes** of the treatment are much the same as in the enteroclysis, when that treatment is given in such a way that some of the solution will be absorbed. The proctoclysis, or Murphy drip method, is a form of enteroclysis in which the solution is introduced into the rectum drop by drop for the purpose of supplying the body with fluid and at the same time freeing the intestines of gases and toxic products, etc. The treatment may be continuous and all the fluid is intended to be absorbed—sometimes a pint an hour may be absorbed.

It is given to supply fluid in postoperative cases, in suppression, in toxemia, and in septic cases, for the purposes mentioned in an enteroclysis.

In septic peritonitis it relieves thirst and dilutes the toxins absorbed from the infected peritoneum. Dr. Murphy also believed that it reversed the flow of lymph in the lymphatics of the peritoneum, that is, that, instead of the toxins being absorbed by the lymph vessels to be carried to the blood stream causing a general toxemia, the lymphatics poured out their lymph into the peritoneal cavity, thus diluting the toxins, and irrigating and flushing out this cavity.

In hypertension and high blood-pressure, a solution containing potassium acetate is given to relax the blood vessels and to increase the elimination of fluid, thus lowering the tension and blood-pressure.

The Procedure.—The important factors to consider in giving the treatment are as follows:

The Solution.—*Plain water* is most frequently used. *Water containing potassium acetate,* one dram to a pint, is frequently used in hypertension to lower the tension and blood pressure. Potassium acetate is a diuretic. Potassium is also a muscle poisoner, that is, it relaxes the muscles of the blood vessels (and other muscles) and so lowers the tension and blood-pressure. The effect of potassium is neutralized by sodium chlorid or common table salt. Nature recognizes this so that when we eat food, such as potatoes, rich in potassium, we, guided by our sense of taste, instinctively demand the use of salt.

A *hypotonic (0.5 per cent.) salt solution,* that is, one containing a lower percentage of salt than the blood or tissues, is sometimes used. A fluid containing a higher percentage of salt (hypertonic) than the blood or tissues would cause fluid to be withdrawn from the tissues instead of being absorbed. A salt solution is more cleansing and is often less irritating to the lining of the intestines than plain water.

A *glucose* solution (5 to 15 per cent.) is frequently used for its nutritive value when sufficient fluid and nourishment cannot be given by mouth as in some post-operative conditions. It prevents the patient from using his own body tissues with the resulting danger of the incomplete oxidation of fats and acidosis.

The *temperature* of the solution should be 118° to 120°. The best method of maintaining the proper temperature is by means of the apparatus shown in Figure **131.** The various devices for keeping the water hot—hot-water bags, flannel, asbestos, etc., around the can or tubing, electric-light bulb in the can, etc.—have proved of little effect unless the water is heated shortly before reaching the rectum. Water flowing drop by drop through the rubber tube (even though kept warm) will be cooled when leaving the catheter.

The solution enters through a catheter inserted into the rectum, a catheter being used because it is small, therefore less apt to irritate and excite the bowel to contraction. All air should be expelled before inserting it. It should be well lubricated but not with glycerin as glycerin stimulates peristalsis.

Care should be taken to see that the catheter is properly inserted, that the solution is being absorbed, that there is no leakage into the bed, and that no pressure on the soft catheter is obstructing the flow. The rectum may become irritated and intolerant of the tube, so that it may be necessary to stop the treatment to give the parts a rest. It may be resumed later. It

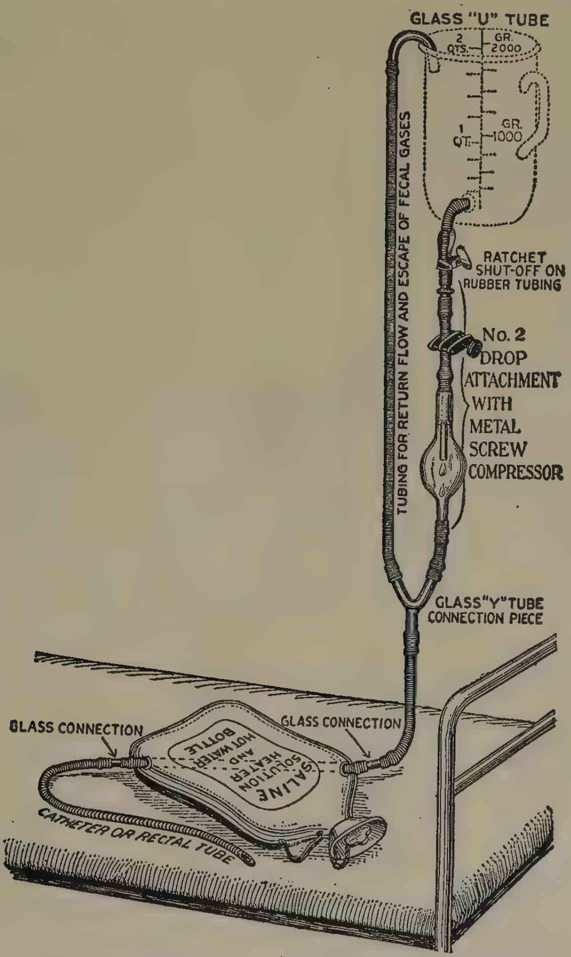
GLASS "U" TUBE
2 QTS.
GR. 2000
1 QT.
GR. 1000
TUBING FOR RETURN FLOW AND ESCAPE OF FECAL GASES
RATCHET SHUT-OFF ON RUBBER TUBING
No. 2 DROP ATTACHMENT WITH METAL SCREW COMPRESSOR
GLASS "Y" TUBE CONNECTION PIECE
GLASS CONNECTION
GLASS CONNECTION
SALINE SOLUTION HEATER AND HOT WATER BOTTLE
CATHETER OR RECTAL TUBE

Fig. 131.—Proctoclysis Apparatus, Consisting of Fountain Syringe, Large Rubber Tube, and Vaginal Hard-rubber or Glass Tip. (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

is wise to have the bed protected. It is also sometimes necessary to disconnect, to remove the catheter to squeeze out air from the tube to allow the solution to run. Some surgeons recommend the use of a hard-rubber nozzle or tip shaped to fit the sphincter. It is said that when the patient is in Fowler's position, the straight tube touches the posterior wall of the rectum and is apt to cause the expulsion of the fluid.

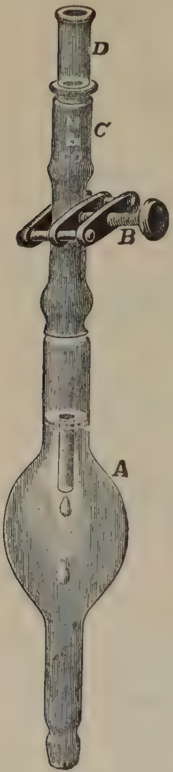

Fig. 132.—Coupling of Glass to be Put in Rubber Tubing so as to Count the Drop-rate, with Compressor to Regulate Flow (Meinecke). (From Hare's "Practical Therapeutics," Lea and Febiger, Publishers.)

The *regulation of the flow* is extremely important. The rate of the flow should be about twenty drops per minute (thirty being the maximum). This may be regulated by gravity, that is, arranging the irrigator at a height just sufficient to obtain a pressure which will overcome the opposing pressure in the intestines (due to gases, fluid, fecal matter, etc.) and allow the solution to enter drop by drop and be retained and absorbed. The base of the container should not be more than from four to six inches above the level of the patient's buttocks. This is usually a very difficult procedure requiring constant readjustment. The use of the apparatus shown in Figure 131 overcomes the difficulty both in regulating the flow and in keeping the solution hot; also in estimating the amount absorbed and in making provision for cleansing the colon by allowing the water to flush back and forth removing the gases, etc., which would otherwise prevent the absorption of the solution. The clamp is used to regulate the flow and by means of the dropper the rate may be observed and counted.

The tubing for the return of flatus, etc., may drain into another container, if desired; otherwise the solution in the irrigator should be changed frequently.

The duration of the treatment may be days, absorption sometimes taking place at the rate of sixteen pints in twenty-four hours.

The *position* of the patient may become exceedingly trying and, when possible, should be changed frequently. She is not likely either to retain or absorb the solution if in a strained, uncomfortable position. She may lie on her side, on her back in the semi-recumbent position, or may be supported in Fowler's position.

In charting the treatment, note carefully the amount of fluid absorbed and the character and amount of fecal matter and flatus, etc., in the rectum.

RECTAL FEEDING OR THE NUTRITIVE ENEMA

Purpose of the Treatment.—The nutrient enema or rectal feeding is the injection into the rectum of concentrated, partially digested liquid food in the hope that part of it at least will be absorbed and supply the body with nourishment. There is little, if any digestion in the large intestines, but considerable absorption of water and of such substances capable of passing through the mucous lining. It is said that only about one-fourth of the body needs can be supplied by rectal feeding but this is sufficient to save the body tissues and to tide over an emergency. This method of feeding can be used for a limited time only, as the intestines soon become irritated and intolerant, especially if the same method is used repeatedly. It may, however, be resumed after a rest. Hare states that "Comparatively recent investigations have proved conclusively that so-called nutrient enemeta aid very little in maintaining nutrition, most of the benefit being due to the fact that the fluid part of the injection is absorbed but the solids remain in the bowel."

Conditions in Which Rectal Feedings Are Used.—Rectal feeding is resorted to when for any reason food cannot be given to the patient by mouth or when it is necessary to spare the stomach. It is used in such conditions as (1) emaciation and depletion in order to supplement feeding by mouth; (2) persistent vomiting; (3) operations on the mouth or jaw; (4) obstruction or stricture of the esophagus or at the pylorus (due to stricture or cancer, etc.); (5) diseases of the stomach and operative conditions such as gastric ulcer; (6) diseases in which the patients are unconscious, irrational or comatose.

The *ingredients* of a nutrient enema vary, but they should always be as absorbable as possible and as only small amounts may be given the food should be concentrated. The foods most likely to be absorbed are peptonized milk, dextrose, sugar of milk, concentrated protein such as liquid peptonoids, beef peptones, either a whole egg or the white of egg, which is albumin, therefore absorbable, beef-juice and whisky or brandy. Alcohol, in ordinary amounts, is one of the best foods for the production of energy. It is readily oxidized and supplies energy for rest or work. It does not build tissue but, for a certain time, will yield the energy that fat would yield and so spares or prevents drawing upon the protein and body tissues for energy. If continued beyond the energy requirements of the body its action on the tissues is destructive. Salt added to the egg aids its absorption. Dextrose has a high nutritive value and as it passes easily through membranes is readily absorbed, but it is also irritating and may prevent absorption by exciting peristalsis.

The retention, possible digestion, and absorption of the nutrient enema depend upon the following factors:

1. Antiperistalsis may carry the food to the colon and cecum.
2. When given to supplement feedings by mouth, digestive

juices from the small intestines may be carried along with the food to the cecum and continue to digest any food present in the cecum just as digestion by the saliva may continue in the stomach until neutralized by the hydrochloric acid.

3. Bacteria, also, always present in the intestines, may act as enzymes by splitting up the food and thereby aiding digestion.

4. Experiments have shown that there is considerable absorption of fluid in the cecum and ascending colon, the contents of the cecum consisting of 90 per cent. water, that of the transverse colon being only 75 per cent. water.

To aid its retention and absorption, the important factors to remember in order to obtain the best results are:

1. The purpose of the enema and importance to the patient. The nutrient enema may be the only means of feeding the patient for weeks at a time, so that as his life may depend upon it, the utmost patience and skill should be used to secure the best possible results.

2. The condition, both mental and physical, of the patient must be such as to aid in the retention and absorption of the nourishment. He must be free from all causes of mental excitement, and of physical discomforts or unrest.

3. The condition of the bowel, also, must be clean and healthy, therefore a cleansing enema should always be given once in twenty-four hours to free the intestine from all residue which, if not absorbed, will be very irritating, causing diarrhea and keeping up a continual unrest preventing absorption. An injection of normal saline is usually given once in twenty-four hours. The saline removes mucus and stimulates the circulation, therefore it is cleansing and aids absorption. A schedule frequently followed for twenty-four hours is:

4 A. M.	A nutrient	enema
8 A. M.	“	“
12 noon	A S. S.	“
4 P. M.	A nutrient	“
8 P. M.	“	“
12 M.	A normal saline enema,	

or the nutrient enema may be given every four hours, the simple enema and the saline enema being given at 10 A.M. and 10 P.M., but frequently passage of the tube is irritating, therefore interferes with retention.

4. The foods used must be predigested, as there are no digestive juices secreted in the large intestine.

5. Small amounts only (4 to 8 ounces) should be given every four to six hours.

6. The injection must be given very slowly and the temperature must be body heat, neither hot nor cold, so as not to excite peristalsis. For the same reason it must be given through a catheter, well lubricated, but not with glycerin, as glycerin stimulates paristalsis. It should be injected as high as pos-

sible so that antiperistalsis can more easily carry it to the part of the colon and cecum where absorption is greatest. To quiet the intestine and prevent evacuation, the injection may be preceded by an opium suppository or tincture of opium may be added to the enema.

7. After the injection the patient should be kept as quiet and comfortable as possible. She must be encouraged to retain the nourishment and must not be worried or disturbed in any way. It frequently helps to have the pelvis higher than the body, to apply pressure against the anus until the desire to expel the enema is passed, or to leave the catheter inserted, with a knot tied in it to prevent the expulsion of the enema. The bedpan should not be allowed the patient for some time after the injection.

When a nutrient enema is given to a patient suffering from hemorrhoids particular care should be taken. Sometimes it is necessary to paint the parts with 2 per cent. cocain and to apply a soothing ointment to the parts in the intervals between the treatments.

When charting the enema, note the time, the ingredients used and whether it was retained or not.

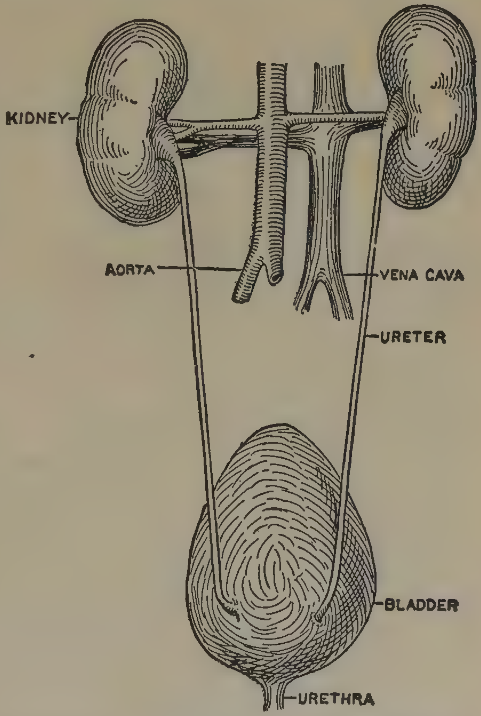

Fig. 133.—The Urinary System Viewed from Behind.

Catheterization of the Bladder

The simpler nursing measures used to relieve retention of urine following an operation have already been discussed in Chapter XII. When Nature and all other methods fail to relieve this condition, catheterization must be resorted to.

This treatment consists in the withdrawal of urine by means of a catheter introduced through the urethra into the bladder.

The Anatomical and Physiological Factors to Be Considered Are as Follows.—The bladder is a highly elastic musculo-membranous sac situated, normally, low in the pelvic cavity behind the symphysis pubis. When distended, it extends above the symphysis pubis and may easily be seen or felt.

The function of the bladder is to serve as a reservoir for urine which is secreted constantly by the kidneys and passed drop by drop through the ureters into the bladder from where it is expelled periodically, usually when it has accumulated to about eight or ten ounces. The normal capacity of the bladder is one pint (500 c.c.) but it may reach to 1000 c.c. under normal conditions and with retention may reach to 3000 or even 4000 c.c.

Retention of urine, if chronic, predisposes to infection. It may also interfere with the work of the kidneys, for the ureters, and therefore the kidneys, cannot empty when the walls of the bladder are distended. Woolsey states that "the *oblique passage* of the ureter through the bladder walls downward and inward for one-half to three-quarters inches . . . *acts as a valve*, preventing reflux into the ureter, so that the fuller the bladder, the more tightly is the ureter mouth closed." Anything which interferes with the free flushing of the kidneys, predisposes them to infection, otherwise prevented by the constant flushing and removal of bacteria and waste products.

The bladder is controlled by the central nervous system. It is supplied by branches of the same nerves which supply the other pelvic organs, rectum and anus, so its function may be affected by operations upon them.

The contraction of the diaphragm in inspiration causes pressure on the abdominal organs and aids in the expulsion of urine.

The urethra is the passageway from the bladder to the exterior. (See Figures 101 and 102). It is situated in the female, in the anterior wall of the vagina with which it is closely associated, so that any packing, growth or other obstruction in the vagina will cause pressure on the urethra and interfere with voiding or the insertion of a catheter. The muscular walls of the urethra are normally in contact but the urethra is quite distensible. Nervousness, exposure and chilling, etc., may cause contraction of the muscular walls making it impossible to pass a catheter. The direction of the urethra, when the patient is in the dorsal, recumbent position, is upward and backward. The length of the female urethra is about 1⅜ inches.

The meatus of the female urethra is situated normally between the labia minora of the external genitals, in the center of the papilla just above the opening of the vagina and about one inch behind the clitoris. It may be hard to find in the following conditions: (1) in children; (2) when the surrounding parts are red and swollen; (3) after an operation such as a perineorrhaphy, sometimes stitches have accidentally been made through the meatus; (4) when the vagina is tightly packed, crowding the urethra and meatus; and (5) in certain malformations, as for instance when the urethral meatus is in the vagina.

The external genitals are never absolutely clean or free from germs owing to the discharges from the vagina and rectum.

Conditions in which Catheterization is Resorted to:

1. *Retention of Urine.*—This may be due to a temporary paralysis following an anesthesia, to dulled senses following the use of drugs such as alcohol and morphin, etc., to paralysis, to shock, to operations on the pelvic organs or on the rectum or anus which are supplied by the same nerves, to loss of tone in the muscles of the bladder or to a nervous contraction of the urethra.

2. *Retention with Overflow.*—In this condition there is voluntary or involuntary micturition, in small, frequent amounts, which does not relieve the bladder. The bladder is distended and can easily be seen or felt and the patient is in constant distress, obtaining no relief from voiding.

3. *Involuntary Micturition.*—This may occur when the patient is in a stupor or coma or may result from injuries to the spine or after an operation such as a prostatectomy.

It sometimes becomes necessary to catheterize patients having involuntary micturition in order to prevent irritation from the urine and breaking down of the tissues or bedsores. Highly acid urine is very irritating. Urine which has decomposed in the bladder or which has been allowed to remain on the skin until decomposed is also very irritating. The irritation and odor of decomposed urine are due to the presence of ammonia which results from the decomposition of urea, the chief ash resulting from the metabolism of amino acids (protein). In the metabolism of amino acids in the body, ammonium products are formed and to prevent their accumulation, these are changed by the liver into urea, a non-irritating substance easily eliminated by the kidneys. Urea is easily decomposed by bacteria.

To prevent bedsores the parts should be absolutely clean and dry, washed with boric acid to neutralize the decomposed alkaline products, rubbed frequently with alcohol and the skin oiled to prevent the urine from coming in contact with the skin.

4. *Catheterization as an Aid to Diagnosis.*

(a) It is sometimes difficult to tell whether the small amount of urine voided is due to failure of the bladder to expel the urine (retention), or to failure of the kidneys to secrete urine (suppression). This is a much more serious condition and if not relieved will finally cause edema, coma, convulsions and death. The patient is catheterized to find out if there is any urine left in the bladder.

(b) Again, when it is necessary to find out whether disease of the urinary tract is due to bacteria, or to find out if bacteria are being passed in the urine from disease of some other part of the body (as in typhoid) it is necessary to obtain a sterile specimen of urine, and this can only be done by catheterization. Urine although free from bacteria when voided, will always contain bacteria after it has passed over the external genitals.

5. *Catheterization to Prevent Infection of a Wound.*—It is a

rule, with some surgeons, to have a patient catheterized every eight to twelve hours following an operation on the perineum or external genitals, etc., to keep the stitches dry and the wound free from infection until it is healed sufficiently to be no longer in danger. Other surgeons feel that, if the parts are kept clean, particularly after the use of the bedpan, the urine will do little harm, whereas frequent catheterization may do considerable harm.

Dangers Involved in Catheterization.—Even when this treatment is given with the greatest care, aseptic precautions, and skill, there is considerable risk of the patient developing *cystitis* as a result. This is particularly true when the treatment must be repeated over a period of days or weeks, or when the patient's general weakened condition predisposes to infection. The danger is also great when in a general septic condition a slight irritation of the lining only is necessary to cause a local infection or when an infection of the external genitals exists. It is therefore resorted to only when absolutely necessary and, as the dangers are more fully recognized and appreciated, it is used much less than formerly. Many surgeons prefer to run the risk of infection of a perineal wound, etc., by allowing the urine to pass over it, rather than run the risk of the patient developing cystitis from catheterization. Following an operation the patient will be allowed to go without voiding, unless in actual discomfort or pain, for a much longer period than formerly, even often for eighteen hours.

Again, the weakened condition of the bladder, which prevents it from emptying itself in the normal way, the interference with its circulation and nervous mechanism which exists, lowers its resistance and predisposes it to irritation and infection. Also, when urine is retained in the bladder it decomposes, liberating ammonia products which are very irritating to all tissues, and predisposes to infection. The bladder is warm, dark and moist and so is an ideal place for bacteria to develop if once lodged there, especially when the free passage of urine is interfered with.

While cystitis is not a fatal disease, it causes a great deal of pain, discomfort and inconvenience, and, once developed, is extremely difficult, if not impossible, to cure entirely. The bladder becomes a weak spot so that cold, exposure or a rundown condition, etc., may cause a chronic condition to flare up and become acute. Cystitis developed in the hospital as a result of catheterization, not only causes great discomfort to the patient, but may involve the hospital in a very costly lawsuit.

It may result from (1) unsterile instruments, utensils or hands; (2) bacteria carried in from the meatus or surrounding parts; (3) traumatic irritation of the lining of the urethra and bladder from the mere passage of the catheter.

Before catheterizing a patient, or even reporting that she is unable to void, every nursing measure should be tried to cause the bladder to empty itself in a normal way. One of the measures of a good nurse is her ability to use her science and art to restore her patient to normal by nursing measures which render drugs and treatments (which may possibly do harm) unnecessary.

The Procedure.—The *principles* to be observed in catheterization are:

1. The prevention of infection by thorough cleansing of the part, by surrounding the part with sterile towels, using sterile instruments and utensils, and allowing nothing unsterile to come in contact with the meatus. Sterile towels are not essential. The most strict asepsis may be observed without them. Some of the very best hospitals do not use them believing that, as they are not always available outside the hospital, nurses should be trained in asepsis without relying upon them where they can, with safety, be dispensed with. In all treatments, simplicity makes for efficiency, and the more simple the technique the less chance for error or for infection.
2. The avoidance of injury by using the proper catheters and the proper method of inserting them.
3. The protection of the patient from exposure and chilling, etc.

The *articles* necessary for catheterizing a female patient are two or three sterile catheters and sterile sponges boiled for five minutes (and brought to the bedside in the receptacle in which boiled), sterile towels for draping (?), sterile basin for receiving the urine, a basin for the discarded sponges and catheter, a basin of hot boric solution for cleansing the parts; the water in which the catheters, etc., are boiled may be poured off and boric acid added. Sterile gloves are sometimes used and sometimes a basin of hot antiseptic solution is brought to the bedside for soaking the hands as a last precaution. Some hospitals use sterile forceps for handling the sponges and catheters and in some, where gloves are not worn, gauze sponges are wrapped around the fingers of the nurse to protect her from infection from a possible infectious vaginal discharge. All the articles may be brought to the bedside on a tray. The sterile articles may be enclosed in a sterile towel.

The *catheters* used may be made of glass, soft rubber or silver.

Glass catheters are about six inches long, with a bent, rounded tip and holes in the side. The advantage of glass is that it is easily kept clean and sterilized. The disadvantage of glass is that it is easily broken or cracked in boiling and may break when in the bladder. This would be a very serious accident. Also, there are conditions in which it would be unsafe to use a glass catheter because of the danger of breakage. They are used only for women.

A *rubber* catheter must always be used (1) for all restless, nervous, delirious or irrational patients; (2) for children and irresponsible patients; (3) for pregnant women; (4) for conditions in which there is a stricture or obstruction in the urethra to the passage of the catheter; (5) following operations on the vagina or perineum; (6) when the vagina is tightly packed making the passage of the catheter difficult and breakage liable if glass were used.

When a rubber catheter is used some authorities consider it necessary to lubricate it with a sterile lubricant, while others consider this unnecessary and that it is safer to use the catheter lubricated only by the solution in which it stands.

Preparation of the Patient.—If the patient is conscious and rational explain the necessity for the treatment and the need for her coöperation. Try to relieve any nervous dread of exposure or discomfort. She should be thoroughly relaxed and remain perfectly still. One of the most essential things in the treatment is a good light. While very little exposure is necessary, the nurse should see exactly what she is doing and be free to give her entire attention to the treatment.

The position of the patient is important. She should lie on her back near the right side of the bed, with her thighs and knees flexed and limbs well separated and relaxed. A blanket should be placed across the chest as it is most important that the patient should not become chilled. Cold causes muscles to contract so that the patient is rigid and also predisposes to cystitis. After the patient's gown, the upper bedclothes, the sterile draping and the utensils (which must be in a convenient position) are arranged satisfactorily and everything is in readiness to begin the treatment, the nurse "scrubs up" after which she must touch nothing unsterile (at least with her right hand). Before leaving the patient to "scrub up" a sterile pad or folded towel may be placed over the vulva to avoid exposure.

Method of Procedure.—The nurse should stand on the patient's right and before touching the catheter she should, with thumb and index finger of her left hand, separate the labia gently but sufficiently to clearly expose the meatus. Then with moistened sterile sponges (in her right hand) she should thoroughly cleanse the parts, wiping gently but firmly from above downward, using each sponge only once and handling it so that her fingers touch nothing but the sterile surface of the sponge. The last sponge is usually left in the vaginal orifice to avoid contact with any discharge which might be present. When this is done care should be taken that this sponge is merely placed in the orifice and not packed in the vagina as this would cause pressure on the urethra and interfere with the passage of the catheter. Then, without removing the fingers of her left hand from the labia, with her right the nurse introduces the catheter directly into the urethral meatus without allowing it to touch anything else. The nurse also, though her hands are "clean," never touches the end of the catheter to be inserted.

Before inserting a glass catheter always examine it carefully for cracks. When inserting a glass (or silver) catheter introduce it with the curved tip pointing upward and direct it upward and backward so as to follow the curve of the urethra. The soft rubber catheter easily follows the curve of the urethra.

Never attempt to introduce the catheter unless the meatus is plainly in view. If stitches or packing prevent this, they will have to be removed by the doctor. Never use force when inserting the catheter, but insert it gently. The muscular walls of the urethra may be contracted due to nervousness, which will pass away, or the patient may voluntarily contract the muscles if she objects to the treatment. Ask her to take a deep breath and to breathe deeply. This takes her mind from the procedure and, also, as it depresses the diaphragm, the abdominal and pelvic muscles are relaxed, and the depressed diaphragm exerts pressure on the bladder, making the introduction of the catheter and the flow of urine less difficult.

The catheter is inserted until the urine begins to flow and no further. As the urine flows, note whether it is clear or cloudy, whether there are signs of blood or pus, and whether such abnormalities appear at the beginning or end, or throughout the flow. If a sterile specimen is desired, the urine should be received in a sterile test tube or bottle, covered or plugged with sterile non-absorbent cotton, and tagged carefully with the name of the ward, the patient, the date, diagnosis of the case, the kind of specimen, and what it is to be examined for. It should be sent immediately to the laboratory for examination. Sometimes the first or the last urine voided is required, otherwise about six ounces of the mixed urine.

When the urine stops flowing, withdraw the catheter slightly so that the end in the bladder will remain in the urine as it reaches a lower level, and wait a moment to see if more urine will flow. If no more comes, then withdraw the catheter (placing a finger over the open end to avoid losing this last specimen which may be desired), hold it over the basin, and, as the finger is removed, the pressure of the air will force the urine out. Place the catheter in the separate basin with the discarded sponges, etc. Before removing the fingers from the labia, cleanse and dry the parts as before.

The treatment may be continued until all the urine is withdrawn or until it stops flowing. The theory that the walls of the bladder if distended may collapse, if the urine is all removed, is (in the belief of most people) an exploded one, as the walls are muscle and highly elastic, the urine is withdrawn slowly and the elastic walls contract as it is emptied.

The patient should experience no discomfort during, and usually feels great relief following the treatment.

Rearrange the bedclothes to the comfort of the patient. Clear away the utensils, etc.

Charting.—Record the treatment, the time, whether it occasioned any discomfort or pain, the amount and character of the urine withdrawn—the color and odor, whether clear or cloudy and whether a sediment appeared on cooling.

CATHETERIZATION OF A MALE PATIENT

Male patients are catheterized by the doctor. Pupil nurses are not taught to pass the catheter on a male patient and graduate nurses are only required to do so in most exceptional cases. Nurses are, however, responsible for preparing the articles necessary for this procedure.

The articles required will be a sterile sheet, sterile lubricant for the catheters, sterile gauze wipes or sponges for cleansing, a basin containing boric acid solution, 2 per cent., a pair of sterile dressing forceps, a sterile receptacle containing several sterile catheters of different sizes, the most commonly called for being number ten, fourteen and eighteen, French soft rubber catheters. A receptacle for the discarded wipes and catheters will also be required.

Rubber catheters are sterilized by boiling for three minutes. Too long boiling softens and roughens the catheters so that they become unfit for use.

Method of Procedure.—If, in an emergency, a nurse is required to catheterize a male patient, she should take the same precautions to prevent infection and exposure as when catheterizing a female patient. The patient may be suitably draped and the treatment performed with very little exposure. The catheter is lubricated with a sterile lubricant. Before inserting the catheter the penis is cleansed; the foreskin is gently pushed back and the glans and meatus are cleansed with the boric acid solution in order to remove any secretions which may be present. The penis is held at an angle of about 60 degrees and the catheter is gently inserted. Frequently some resistance to the passage of the tube is met with, due to the contraction of muscles. When this occurs wait a moment and the catheter can then be gently inserted further. Force must never be used in passing a catheter as great and permanent harm may be done in this way. If the resistance is due to the nervous contraction of the muscles it will soon pass away; if not, further attempts to pass the catheter will only do harm. After the urine is removed from the bladder the parts are cleansed and dried as before.

CARE OF CATHETERS

The care of catheters may differ somewhat in different hospitals, but the following methods have been found satisfactory:

Glass catheters are used for women only. After use, they are washed with green soap and tepid water, rinsed in clear water, and boiled for ten minutes. When not in use, they may be stored in a 1 to 40 carbolic acid solution.

Soft Rubber Catheters.—After use they are cleansed with green soap and tepid water, irrigating from the eye downward. They are boiled for ten minutes to sterilize. If to be kept sterile when not in use they are drained and dried in a sterile towel and put away in a dry sterile towel. These catheters are then considered clean, not sterile, and are resterilized by boiling before use. It is customary in most hospitals to keep a set of sterile catheters of various sizes on the ward for emergency use. A convenient method of doing so is to place the catheters, sterilized by boiling after use, in a sterile glass tube, long enough to accommodate the catheters without bending. They are then sent to the operating room to be sterilized in the autoclave by steam under pressure for fifteen minutes. When not used on the ward they should be sent to the operating room in the tube to be resterilized once each month.

Gum Elastic Catheters.—These may be cleansed in the same way as rubber catheters and sterilized by boiling. These catheters become very soft and are very easily injured and ruined when hot. If not properly treated they roughen, bend, and lose their shape so that they are unfit for use. Roughened catheters, whether of glass, rubber or gum elastic, etc., should never be used. They irritate the delicate mucous membrane of the urethra and predispose to infection. To boil gum elastic catheters they should be rolled in gauze so that they do not touch each other. The vessel in which they are boiled must be longer than the catheters so that they do not become bent. The water must be boiling and the catheters should not remain in the water longer than necessary. They should be lifted from the water in the gauze in which they are wrapped. The catheters themselves must not be touched until they are cold.

Lisle Thread Catheters.—These, like gum elastic catheters, are very expensive and very easily injured. After use they are cleansed with green soap and tepid water. They may be sterilized by boiling for one or two minutes or by soaking in a 1:1000 solution of bichlorid of mercury for one hour, and stored away in sterile glass tubes. If not used they are resterilized at least once a month.

A Bladder Irrigation

A bladder irrigation is used when a patient is suffering from *cystitis.*

Cystitis is inflammation of the mucous lining of the bladder.

Causes of Cystitis.—The *direct* cause is the presence of microorganisms in the bladder. The organism may be the tubercle bacillus, the gonococcus, the colon bacillus, the staphylococcus pyogenes or the bacillus typhosus, etc. It may be carried to the bladder with the urine from the kidneys or the blood stream, or it may enter from the urethra or the external genitals.

The *predisposing* causes are (1) tumors; (2) calculi and other foreign bodies; (3) urethral inflammation or obstruction; (4) injury; (5) exposure to cold; (6) atony, as in old age, resulting in retention and decomposition, or anything which interferes with the normal flow of urine; (7) paralysis as in paraplegia, etc.

The *urine* in cystitis may have a fetid odor, due to the action of bacteria, or the odor of ammonia, due to decomposition of urine in the bladder. It may be cloudy or turbid, due to the presence of the products of inflammation, and may contain a large amount of mucus, many leucocytes, and epithelial cells, blood, pus, and calculi or gravel.

The **purposes** of the treatment are:

1. To cleanse or remove accumulated mucus, pus and other irritating products of inflammation and decomposition.
2. To relieve pain, inflammation, and congestion.

Bladder Irrigations are Contraindicated in the Following Conditions:

1. In acute cystitis, until the acute stage has subsided, as the lining is so very sensitive.
2. In acute urethritis, to avoid spreading the infection to the bladder.

The Procedure.—*The Articles Required.*—These will depend somewhat upon the technique used. In addition to those used for catheterization, the following articles will be required: a sterile pitcher containing the sterile solution ordered and covered with a sterile towel, a receptacle for the return (a douche pan may be used), and a sterile glass funnel attached to the catheter to be used. Rubber catheters are always used. Sterile draping is always advisable for a bladder irrigation. The treatment is much more complicated and prolonged than catheterization. It is also required less frequently so that nurses may not have sufficient practice to develop the skill necessary before sterile draping can, with safety, be dispensed with.

The *solutions* commonly used are: boric acid, 2 to 4 per cent., and sodium chlorid one dram to a quart. Sodium chlorid is stimulating; it cuts mucus and is cleansing, and it is less irritating than plain water. Other antiseptic solutions are sometimes used, such as potassium permanganate, bichlorid of mercury, formalin, argyrol, silver nitrate, mercurochrome, acriflavine and neutral acriflavine.

The *temperature* of the solution for cleansing purposes should be near that of the interior of the body (the average temperature of the blood being 102° F.), as the mucous lining of the bladder is extremely sensitive to temperatures either much above or below that of the interior of the body. The temperature should be from 104° to 106° F.; if cool or hot it will cause marked contraction of the bladder wall with considerable pain.

The *amount of solution* used varies as the treatment is continued until the return is clear. Usually two or three pints are necessary.

The *position and preparation* of the patient will be the same as for a catheterization. In this treatment it is exceedingly important that you should avoid the slightest chilling of the patient, allowing as little exposure as possible. Cold is one of the predisposing factors in cystitis and chilling may bring on an acute attack with very distressing symptoms. Therefore, see that the feet and body are kept warm by using blankets. If the treatment is given with the douche pan under the patient for the return, see that it is not placed under her before necessary, and see that it is well padded or protected as the treatment is rather lengthy. The douche pan should be warm.

Method of Procedure.—Strict asepsis must be observed throughout. First empty the bladder by catheterization, using the rubber catheter with the funnel attached, inserting the catheter with the utmost care and gentleness. Hold the funnel so that it will not be contaminated by contact with an unsterile surface. A long tube is unnecessary as no force should be used.

If a specimen of urine is desired or if a urine record is kept, the specimen should be received in a separate basin. The urine should be measured and the amount charted.

After the bladder is emptied, the solution is poured into the funnel and allowed to run slowly, with little force. The amount allowed to enter the bladder before siphonage varies from about 1 to 4 ounces but the usual amount is about four ounces. When the bladder is very sensitive or when much contracted, sometimes it is impossible to introduce even one ounce without causing distress. Again when it is desired to distend the bladder completely, one pint may be injected before siphonage in order to smooth out the lining (which is arranged in folds when the bladder is empty or contracted) so that the solution will reach and cleanse all parts. This is usually not permitted without express orders from the doctor. As soon as the desired amount has been introduced and before the funnel is empty, it should be allowed to pass out immediately, allowing the bladder to empty itself normally and not pressing upon the lower abdomen to hasten its discharge. Before the bladder is quite empty, that is, before the return ceases to flow, introduce more solution so as to avoid the irritation which will result from the continued strong contraction of the bladder upon itself.

This flushing of the bladder is continued until the return is clear. Finish as for a catheterization. In some hospitals, instead of a pitcher and funnel, a douche bag and rubber tubing, etc., are used for irrigating. A recurrent catheter is, also, sometimes used so that the inflow and outflow are continuous.

In charting, note the amount of urine withdrawn, the amount of solution, and the character of the return.

A Bladder Instillation

In the treatment of cystitis, various antiseptic solutions—silver nitrate, argyrol, potassium permanganate, etc.—are sometimes introduced into the bladder as a local application to the mucous lining, in order to prevent the development of bacteria and decomposition of urine.

The drug ordered may be introduced after the bladder has been emptied by catheterization, or a bladder irrigation may precede the treatment.

In any case the preparation is the same as for a bladder irrigation. In addition, a sterile measuring glass containing the drug will be necessary. Before pouring the drug into the sterile measuring glass, wipe off the rim of the bottle with alcohol and do not touch the glass with the bottle or anything else unsterile.

When the patient has been catheterized or the bladder irrigated, without removing the catheter or funnel pour the drug into the funnel and allow it to flow slowly into the bladder. Finish as for a catheterization.

Chart the treatment, and the amount and strength of the drug used. Note whether the instillation caused the patient any pain; if so, a weaker solution will probably be required.

CHAPTER XXXII

THE POST-OPERATIVE TREATMENT AND NURSING CARE OF PATIENTS (Continued)

A major operation always makes a heavy drain on a patient's vitality, but even a minor operation may result in serious consequences either because of the patient's condition previous to the operation, or because of complications which may come in its train.

The conditions most to be feared—what the nurse watches most anxiously for—are *shock, hemorrhage, infection of the wound,* and *complications* such as cellulitis, septicemia, peritonitis, pneumonia, and pulmonary embolism.

These conditions will be discussed in the present chapter. In the treatment of each *prevention* is the best cure.

SHOCK

All patients, probably, suffer to a greater or lesser degree from post-operative shock. It is an extremely serious condition and, if not recognized and treated immediately, may prove fatal. Some understanding of the changes occurring in the body and the various factors which tend to produce the condition of shock should help the nurse to recognize its symptoms and impress upon her the need and the means of preventing its development or of treating it promptly when present.

Explanation of Shock.—Shock is a condition of depression affecting almost all the functions of the body. The degree of depression varies from a feeling of slight weakness, nausea, and dizziness to a complete failure of the vital functions. No satisfactory explanation of this condition or of just what happens in the body has as yet been made although an immense amount of experimental study has been devoted to it. Various theories are advanced. The explanation generally accepted is that, while other factors may enter, the loss of vasomotor control is the constant and all-important factor in the development of shock.

It is believed that, as the result of profound psychic disturbances, or of severe mechanical injuries, especially if accompanied by pain, impulses are conveyed to the brain by afferent nerves which cause a marked depression of the vital centers. The result is the loss of vasomotor control, embarrassed respirations and heart action, and a tendency to lessened heat-production with an increase in heat elimination. As the result of vasomotor paralysis, the blood-pressure is greatly reduced, the large splanchnic veins become dilated and engorged with blood which stagnates there instead of flowing on to feed the heart, and to be purified in the lungs, and to feed the body tissues. As the heart receives very little blood, it can deliver only small amounts to the arteries, so that the brain with its vital centers, the heart muscles, and other tissues are starving for food and smothering for want of oxygen.

The starved heart muscle loses strength, its beats become very weak so that the blood-pressure, which depends largely upon the force of the heart-beat, is still further reduced and the tissues still further depleted. The conscientious heart, in order to make up for the small output at each beat, works faster and faster in order to raise the blood-pressure and keep the blood circulating to meet the demands of the tissues. The heart is usually the last worker to give up the fight, and, if supplied with more blood, quickly revives and goes cheerfully on with its work.

The starved brain and its nerve centers become more depressed, the respirations rapid, shallow and irregular, the pulse rapid, weak and irregular, the blood-pressure very low, and the patient quickly sinks into a condition verging on complete unconsciousness and total collapse.

Causes of Shock.—*Predisposing Causes.*—Shock is much more apt to develop in the old, weak, or poorly nourished, in patients with a highly impressionable nervous system, and in those exhausted by either mental or physical strain or poisoned by alcohol or other drugs.

Exciting Causes.—Any agent which produces a violent impression on the central nervous system or any agents, such as ether or chloroform, which are highly toxic and cause marked depression, may produce shock.

Common Causes.—(1) Violent emotions such as grief or fear, both of which cause marked depression of the whole nervous system and therefore of the vital centers. (2) Extreme pain such as may precede or follow an operation or accompany severe burns, crushing injuries or laceration and mangling of the tissues by machinery. (3) Operations or injuries with prolonged exposure of the patient with loss of body heat. (4) Exposure or rough handling of the abdominal viscera in operating. (5) Operations or injuries accompanied by severe hemorrhage or injury to nerve trunks. (6) Extensive wounds in the skin. (7) Direct pressure over the heart and large blood vessels, and injuries to the larynx.

Symptoms of Shock.—The following description is given by Dr. W. G. MacCallum as a typical example of shock: "A strong and perfectly healthy young man was struck in the abdomen by the pole of a carriage drawn by a runaway horse. No recognizable injury was done to any of the internal organs. Nevertheless, grave symptoms made their appearance immediately after the accident. The injured man was lying perfectly quiet, and paid no attention to anything going on around him. His face was drawn and peculiarly elongated, the forehead wrinkled, and the nostrils dilated. His weary, lusterless eyes were deeply sunken in their sockets, half covered by the drooping eyelids and surrounded by broad rings. The eyes had a glassy and vacant expression. The skin and the visible mucous membrane had a marble-like pallor. Large drops of sweat hung on forehead and eyebrows. The rectal temperature was subnormal. The sensibility of the entire body was greatly reduced; the patient reacted slightly, and only to very painful impressions. No spontaneous movements of any sort were made by the patient. On repeated and urgent requests he showed that he could execute limited, brief movements with his extremities. When the limbs were lifted passively, then let go, they fell down like lead. The sphincters were intact. The urine obtained by catheter was scanty and concentrated, but otherwise normal. The almost imperceptible pulse was rapid, irregular, and unequal. The arteries were narrow and of very low tension. The patient answered slowly, reluctantly, and only after repeated urgent questioning. His voice was hoarse and weak, but well articulated. On being repeatedly questioned, the patient complained of cold, faintness, and deadness of all parts of the body. When he shut his eyes he felt nauseated and dizzy. The respirations appeared irregular; long, abnormally deep, sighing inspirations interchanged with rapid and superficial ones, which were scarcely visible or audible."[1]

To summarize.—Following an operation (or injury) the symptoms to be watched for most closely are apathy, pallor, a pinched drawn face, cold, moist, clammy skin, extreme weakness, a rapid, weak, irregular pulse, rapid, sighing, irregular respirations and lowered blood-pressure.

Treatment of Shock.—*Prophylactic.*—The treatment before an operation is extremely important, quite as important as that following, for it may prevent shock to a large extent. The need of a good night's rest, of comfort, warmth, a cheerful, hopeful frame of mind, a body well nourished and tissues well supplied with water has already been dwelt upon in an earlier chapter.

Anoci-association in the Prevention of Shock.—The belief that shock is due to afferent impulses either psychic or traumatic in origin has led to the application of anoci-association to prevent operation shock. (The word *noci* comes from the Latin word *nocere*, to injure.) Anoci-association means the exclusion of all harmful impulses, influences, or associations.

Before the operation, the harmful and depressing effects of anxiety, fear, and dread of pain are prevented by numbing the brain with hypodermic injections of morphin and scopolamin. Sometimes, during the operation—for instance, in exophthalmic goiter—the field of operation is blocked off and all pathways broken by injections of novocain, so that no harmful impulses reach the central nervous system from the injured tissues. Before closing the wound, quinin and urea hydrochlorid are injected around the whole area so that for several days after the operation, no impulses reach the brain from the injured tissues.

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[1] "Text-Book of Pathology," by Dr. W. G. MacCallum.

This method has been developed, and is recommended by Dr. Crile because he believes that general anesthesia does not protect the brain cells from harmful stimuli from the tissues operated upon, and that these play an important part in the development of shock.

During an operation the patient is kept well under the anesthetic to prevent harmful impulses reaching the brain. All bleeding, if possible, is completely checked. The operation is performed with speed and the patient returned promptly to a warm bed. In an abdominal operation exposure is avoided, the contents are handled as little and as gently as possible and are protected with hot saline pads.

After the operation the patient should be placed in the recumbent position, kept absolutely quiet and moved about as little as possible in order to relieve the work of the struggling heart. The room should be dark and no visitors, or talking, or noise of any kind, likely to disturb the patient, allowed. Morphin is usually ordered to prevent pain, one of the common factors in the development of shock.

The patient's head should be lowered by raising the foot of the bed or placing him in the Trendelenburg position in order to supply the anemic brain with blood and revive the vital centers. To further increase the blood supply in the heart and brain, the extremities may be bandaged—the arms, from the fingers to the shoulders; the leg, from the toes to the hips.

No tight clothing or weight of bedding should be allowed about the chest as this would further embarrass the breathing.

To prevent heat elimination and to raise the body temperature, heat in the form of extra blankets, hot-water bottles, and friction with a warm towel to the extremities should be applied. Friction with the warm towel stimulates the circulation, removes perspiration and dries the patient. (In treating an accident case for shock, never allow the patient to remain on the cold ground or floor even if warmly covered.) It is said that hot fluids by mouth have little effect, as they remain unabsorbed in the stomach, but that after reaction has set in they are valuable.

To stimulate the heart, a mustard plaster or local heat is sometimes applied over the heart. Care must be taken not to oppress the chest as pressure on the chest will increase the shock.

To increase the volume of blood, to increase the force of the heart and raise the blood-pressure, direct transfusions of blood or repeated intravenous infusions of hot normal saline solution, with or without adrenalin, may be given.

Various *stimulants*—atropin, strychnin, whisky, caffein, camphor, hot coffee (caffein), and digitalis—are extensively used, but it is said that recent studies seem to contraindicate their use as they tend to stimulate consciousness or open up pathways for afferent impulses, thus intensifying shock (Hare).

They are, however, valuable and are given in cases of extreme shock to ward off immediate death and revive the patient while other treatments are being prepared. When large or repeated doses of stimulants are given it is important to watch later for symptoms of cumulative poisoning.

The *treatments* used to relieve *shock* are much the same as those used to relieve the effects of hemorrhage. They will, therefore, be discussed under the treatments for hemorrhage.

HEMORRHAGE

As life depends upon a free supply of blood to all the vital centers in the brain, the vital organs, and all the tissues of the body, loss of blood is, perhaps, the most serious condition which may endanger the life of a patient, following an operation. The possibility of a hemorrhage should be constantly present in the mind of the nurse in charge of the patient, for his life will depend upon its prompt recognition and prompt, intelligent control. Not one drop of blood should be unnecessarily lost. Thousands of patients owe their lives to the quick recognition of the first signs of hemorrhage. The patient's life is, therefore, in the hands of the nurse. If her care is to be intelligent she should know whether the patient's previous condition makes him more liable to bleeding as in hemophilia, jaundice, or diabetes; whether the patient has lost much blood during the operation, and in whom the loss of blood is particularly serious, as in the old or very young, and in those in whom the vitality is lowered from any cause. She should know in, or after, which operation bleeding is most likely to occur as in operations on the spleen, liver, pancreas, gall bladder, kidneys, uterus, rectum, tonsils, mouth; and also in infected wounds, and in operations involving large raw surfaces. She should also know and be able to recognize the earliest symptoms and should know what to do and how to do the right thing instantly should a hemorrhage occur.

Bleeding which occurs at the time of the operation or within the first twenty-four hours is called a *primary hemorrhage*. It may be (1) a steady oozing from capillaries which may be profuse, particularly if the wound involves a large area or, (2) bleeding from small blood vessels not tied off at the time of the operation or, (3) bleeding from a large vessel due to the slipping of a ligature.

At the time of the operation, owing to the depressing effect of the anesthetic on the circulation, bleeding from the capillaries may be very slight and the clotting of the blood easily controls it; bleeding from the small blood vessels may be so slight as to be overlooked by the surgeon so that they are not tied off, or, a ligature around a large vessel may be tied too near the cut edge, or it may not be tied securely. As the depressing effect of the anesthetic wears off, the heart-beat becomes stronger and the blood-pressure is increased so that blood clots are easily displaced and bleeding begins from the capillaries and small blood vessels. The increased blood-pressure may cause a ligature to slip so that bleeding may occur from a large vessel. Restless movements of the patient increase the rate and force of the heart-beat and raise the blood-pressure, thus greatly increasing the danger of hemorrhage.

Bleeding may be *external, sudden* and *large* or it may be *external* and *gradual*—in either case it should be recognized instantly both by the external evidence and systemic symptoms. Where the wound is closed, with no means of drainage, or when the wound is tightly packed, the bleeding will be *internal;* that is, into the tissues or into a body cavity. An *internal hemorrhage* may also be *sudden* and *large,* in which case the systemic symptoms are very marked and unmistakable, or it may be very gradual, in which the condition may be mistaken for prolonged shock. This is a serious error as stimulants are given to relieve shock, but are avoided in hemorrhage as they, of course, would increase the amount and rapidity of the loss of blood.

A hemorrhage is said to be *secondary* when it occurs any time after the first twenty-four hours up to the time of complete healing of the wound. A secondary hemorrhage is apt to be severe as it usually occurs from a large vessel, the smaller vessels being always occluded after the first twenty-four to forty-eight hours. It is to be watched for, particularly in septic wounds where there is sloughing of the tissues, with which there may be sloughing and slipping of ligatures or erosion of the walls of the blood vessels.

Signs of Hemorrhage.—The dressing should be watched for any staining with blood. If the dressing is stained, the spot should be watched to see if it increases in size. When examining a dressing for staining, always examine the binder or bandage on which the patient is lying. The outer non-absorbent covering of the dressing may prevent the binder or bandage immediately over the wound from being stained but the blood will escape from beneath the dressing and flow by gravity to the lowest point, so that the binder and bed beneath the patient may be saturated before any staining appears on the outer dressing.

An *internal hemorrhage* is indicated by the systemic symptoms.

Systemic Symptoms of Hemorrhage.—Dr. Brewer describes these symptoms as follows:

"A moderate loss of blood in a vigorous, healthy individual produces no symptoms other than a feeling of slight weakness. If the amount lost is greater, there is a feeling of giddiness, dyspnea on exertion, mental confusion, and a disposition to faint. In severe cases there may be in addition thirst, air-hunger, partial blindness, ringing in the ears, and suspended consciousness. Accompanying these symptoms there are pallor, coldness of the extremities, a moist, clammy skin, rapid sighing respiration and restlessness. The pulse is rapid, feeble, thready, irregular, and compressible; the temperature is sub-normal; there is great physical weakness; nausea and vomiting may occur; the pupils are dilated, the eyes often fixed, the countenance expressionless. In continued hemorrhage these symptoms are all exaggerated, consciousness is lost, tremor or convulsions may be present, the pulse becomes imperceptible, the heart fluttering, and death speedily occurs. DaCosta states that death may be expected if one-half the volume of blood is lost. It often occurs with much smaller hemorrhage if the loss is rapid or accompanied by shock from other causes.

"Shock and hemorrhage have so many symptoms in common that it is often difficult to make a differential diagnosis. The question may be a serious one, especially after operations, as it is most important to know whether a given condition of weakness is due to the shock of operation or to concealed hemorrhage, which necessitates immediate operation in order to stop the hemorrhage. In general it may be said that in shock the patient is weak and apathetic, while in hemorrhage he is weak and restless. Frequent examinations of the blood should be made in doubtful cases; a progressive diminution of hemoglobin and the red cells indicates hemorrhage."

Treatment for Hemorrhage.—If the dressing shows staining or if there are symptoms of internal bleeding, the surgeon should be notified immediately. The dressing should be "reinforced" by the application of more pads and the bandage or binder may be tightened. A dressing, moist with blood or other body fluids, should never be left exposed as it favors infection and forms an excellent culture medium for germs. The dressing must not otherwise be disturbed until the arrival of the surgeon. In the meantime the patient must be kept absolutely quiet to lessen the work of the heart and prevent increase in blood-pressure. He should have plenty of fresh air. If the bleeding is from an extremity, the limb should be elevated and digital pressure made on the bleeding vessel; if the bleeding is internal, and in any case to relieve systemic symptoms, the head may be lowered, the trunk and extremities being elevated to cause more blood to flow to the brain to supply the vital centers. An ice-bag may be applied over the bleeding area. No stimulants should be given. Preparations should be made for what the surgeon may be expected to need on his arrival. Morphin is usually ordered at once to quiet the patient. The local treatment may include changing the dressing, searching for and ligating the bleeding vessel, packing the wound and applying pressure, and irrigating with a very hot or cold solution. Sometimes, to give the heart more blood to pump and keep the blood where it is vitally needed, the limbs are temporarily deprived of blood by bandaging from the fingers and toes toward the heart. These measures in the ward may be only temporary for immediate control, the patient being taken later to the operating room, where the wound is reopened and the bleeding vessels ligated.

After the hemorrhage is controlled, to increase the volume of blood, the patient may be given direct transfusions of blood, an intravenous injection, or a hypodermoclysis of normal saline solution. Heat is applied to the extremities and hot fluids are given by mouth or by rectum. To relieve thirst and supply the tissues with fluid, water may be given freely by mouth or by rectum. Later, to aid Nature to repair the loss, the patient must have rest, fresh air, sunlight, nutritious food, and tonics. Usually iron and arsenic are given to increase the hemoglobin and stimulate the blood-forming organs.

TRANSFUSION

A transfusion is the transfer of blood from one person (the donor) to another (the donee or recipient). It has proved of great value in the following conditions:

1. Following a severe hemorrhage.
2. In hemophilia and other conditions with lessened coagulability of the blood.
3. In severe anemias (and leukemia). In secondary anemia it restores the volume of blood and tides over an emergency until the blood-forming organs can replace the loss. In pernicious anemia, an incurable disease, it gives temporary relief and prolongs life.
4. In collapse or shock from any cause.
5. In malnutrition or marked prostration.
6. In septicemia, in severe toxemia from sepsis, gas poisoning (carbon monoxid, etc.), or acid intoxication. Some of the poisoned blood may first be withdrawn and replaced by the donor's blood.
7. Before an operation when the patient is in a very weakened condition. Prior to and immediately after an operation to prevent shock. After an operation, particularly on the stomach, when the patient is starved for food.
8. In patients suffering from malignant growths in order to increase their general resistance so as to guard against other diseases, such as pneumonia.

Effects of the Treatment.—Its advantages over the saline infusion are said to be that, (1) it supplies nutritive material, oxyhemoglobin, and carbon dioxid, and tends to overcome acapnia (diminished carbon dioxid in the blood), in shock; (2) it does not transude so quickly from the blood vessels, and is not so quickly excreted as saline, and therefore maintains the blood-pressure in hemorrhage longer and causes increased coagulability of the blood.

There are various theories explaining the undoubted benefits derived in pernicious anemia, but the chief benefit is said to be its stimulating effect, especially on the bone-marrow. Dr. Vogel states that "in the opinion of most authors, the transferred blood acts as a stimulant, especially to the blood-forming organs, and, at least for a time, revives the power of blood regeneration."

There are certain *difficulties and dangers* encountered in a transfusion which necessitate the greatest caution, both in selecting and securing a donor, and in the method of collecting and transferring the blood. They are:

1. The difficulty in securing a donor, also the expense involved.
2. The danger of the blood clotting during the transfer.
3. The danger of injury to the blood vessels.
4. The danger of transferring diseases, such as syphilis.
5. The danger from incompatibility of patient's and donor's blood.
6. The possible collapse of the donor, and in some cases the veins of the recipient are small, collapsed, buried, and easily torn, making the treatment difficult.

Before using the donor's blood, to avoid the dangers of 4 and 5 above, it is very carefully examined. The following tests are made: A red and white blood cell count, hemoglobin determination, a platelet count (platelets are concerned with the clotting of blood), a Wassermann test to exclude the possibility of conveying syphilis, a test for "grouping," and a test for isohemolysins and isoagglutinins.

The *test for grouping* is based on the following conclusions: It is a well-known fact that the blood of animals cannot be injected into human beings without producing serious or even fatal results. It is now also known that the blood of one individual when injected into another may cause very serious results, even though they be members of the same family. It has been shown, however, by different authorities that human blood can be classified into four groups, and that each individual will fall into one of these four groups. The greatest number fall in group four, next in group two, next group three, the least number being in group one. Thus standardized serum for each group may be obtained and kept in the laboratory. The blood of donors willing to contribute is then matched up with these standards, or "grouped." The blood of the patient is also "grouped" in the same way. Several classifications have been used to designate blood groups. The two most widely used are the Jansky and the Moss classifications. It is very important in grouping a patient and a donor that the same system of classification be used for both, as serious results might occur through confusion. Therefore in reporting the blood group of any individual the classification used should always be stated, as follows: *Blood Group 1, Moss classification.* If the donor and the patient belong to the same group some doctors think it safe to transfuse the patient. Some doctors, however, to avoid the danger of incompatibility and a possible reaction, further safeguard by testing for isoagglutinins, that is, testing the effect of the patient's serum on the blood cells of the donor, and the effect of the donor's serum on the blood cells of the patient to find if they are "mutually congenial."

Isoagglutinins are substances in the serum of the blood which will cause agglutination, or clumping together, of the cells in blood of the same species; iso comes from the Greek word *isos*, meaning equal or the same. Isoagglutinins in the patient's serum would clump together the blood cells, injected from the donor and vice versa. In either case the treatment would prove very harmful.

Another test sometimes done is for isohemolysins (*iso*, the same; *lysis*, to destroy), or poisons in the serum which would destroy red blood cells (hemolysis). Many doctors now consider this unnecessary as, in the absence of isoagglutinins, isohemolysins are believed also to be absent.

If the donor can be secured the tests can be completed in from one-half to one hour.

The amount of blood injected will depend upon the donor, the condition of the patient, and the purpose for which it is given. When given to stimulate the bone-marrow, as in pernicious anemia, it is believed that small amounts repeated as the condition demands, give better results than when large amounts are used and that larger amounts may even be injurious (Dr. Vogel). The usual dosage for infants varies from 80 to 150 c.c. and for adults from 500 c.c. to 1000 c.c.

In some hospitals or laboratories, in the study and treatment of pernicious anemia a very interesting test called "vital staining" is done as a means of studying the activity of the bone-marrow in forming new red blood cells. Following a transfusion it is done to determine the beneficial or stimulating effect of the treatment on the bone-marrow.

The "vital staining test" is based upon the fact that by a special method of staining red blood cells a network of fine threads or reticulations is seen in young cells so that the percentage of reticulated red cells in the blood indicates the activity of the bone-marrow and its capacity to replace red blood cells. In the blood of infants these reticulations are found in from 5 to 10 per cent. of the red cells, and in the normal adult in from 0.5 to 2 per cent., while in severe anemia they may form 18 to 20 per cent. of the red cells (Dr. Vogel).

Following the transfusion if the percentage of reticulated cells is not increased, it shows an inability of the bone-marrow to respond to stimulation.

Methods of Transferring Blood.—Having secured a suitable donor, there are several methods by means of which blood may be transferred. It may be transferred directly by means of a special apparatus which connects the vein of the donor to a vein of the recipient. This method is called the "Unger Method" after Dr. Unger, who perfected it. It requires a great deal of skill and practice on the part of the operator. Its disadvantages are said to be that it takes considerable time and so is very trying for both donor and patient. The blood vessel becomes injured and it is difficult or impossible to estimate accurately the amount of blood transferred.

Another method, the "Lindeman method," is accomplished by means of several 20 c.c. syringes with a special set of cannulas, devised by Dr. Lindeman, by means of which even small veins may be entered easily with little danger of injury. Three operators perform the treatment. One withdraws blood into a syringe from the donor and passes it to the second doctor, who injects it into a vein of the recipient, then passes the empty syringe to the third operator, usually a nurse, who washes it out with sterile saline solution before passing it to the first doctor. This is repeated until the desired amount is given or until the donor shows signs of weakness. This can be done quite rapidly by experts with little danger to either patient or donor, and the amount withdrawn and injected can be accurately reckoned.

The third method is called the "citrate method." It consists in withdrawing the blood from the donor into a flask (warm) containing sodium citrate which prevents the blood from clotting. The blood in the flask is stirred very gently with a glass rod in order to mix the citrate evenly without causing injury to the cells or clotting. This may be kept several hours. It is injected into a vein of the recipient in the same way as a saline infusion. A flask of normal saline will also be necessary. The saline is first injected to insure that the needle is properly inserted in the vein and after the blood is injected to insure that all the blood will be washed from the tubing and needle into the vein so that none will be lost.

The "citrate method" has been used very extensively, and during the recent war was a means of saving many lives. The results from this method are said, by those who use it, to have been satisfactory. The amount given is accurately known. It occasions the least inconvenience and is the least energy- and time-consuming for both donor and recipient. It is the least difficult method and is best adapted to ordinary practice, and therefore serves a wider use. It is particularly valuable in cases of emergency as, for instance, where used for the purpose of replacing blood lost in a severe hemorrhage.

Those who advocate the direct method of transfusion either by the "Unger" or "Lindeman" method claim that there are disadvantages in the use of the "citrate method." They claim that febrile reactions and chills occur in a much higher percentage of cases than where unmodified blood is used as in the direct method of transfusion. It is thought that the difference in reaction is due to an abnormal condition of the blood platelets and the red cells in the citrated blood. Some authorities believe that blood acquires toxic properties in direct proportion to the path it has traveled toward coagulation, and that even though it does not absolutely coagulate, changes take place as it is poured from the vessels which render it less suitable. The chemical alteration caused by the addition of the sodium citrate is said to increase the fragility and the tendency to hemolysis of the red cells. In the direct method it is claimed that the lessened amount of handling and the shorter time that the blood is out of the body lessen its progress toward coagulation and therefore the harmful changes in its character.

Whatever method or technique is used, needless to say, it must be conducted with the most strict aseptic precautions.

Method of Procedure.—During the withdrawal of blood the donor should be in the recumbent position, made thoroughly comfortable, and allowed to remain in this position for some time following the treatment. Any nervousness on his part should be dispelled. His color, pulse, blood-pressure and general condition should be carefully watched, and stimulants should be in readiness and used if necessary. An extra blanket, and ice water, etc., should be at hand. An increase in the respirations and pulse rate, yawning or deep sighing indicate that the withdrawal of blood should be discontinued. Pallor and sweating sometimes occur followed by collapse.

For the withdrawal of blood the following articles are usually used: A rubber to protect the bed, sterile towels, a disinfectant for the skin, sterile cotton, sterile albolene (to coat the inside of needles, etc., to make the surface smooth and prevent clotting), needles, rubber tubing, a glass graduate to receive the blood, sodium citrate solution, 3 per cent., a small glass graduate with which to measure the citrate (50 c.c. of citrate solution are used to 500 c.c. of blood), a basin of warm water in which to stand the flask to keep the blood warm, a glass rod, and a sterile dressing. The Unger needles are commonly used.

The method of withdrawing the blood will be the same as that given under "Phlebotomy," Chapter XXII.

The recipient must also be made quite comfortable and kept very quiet during the treatment. Restlessness and jerking of the arm make it very difficult to proceed, and may cause injury to the vein, displacement of the needle, hemorrhage, and loss of blood. The patient's color and pulse should be noted before the injection. During the treatment it is very satisfying and fascinating to watch the color gradually appearing in the finger nails, and lips, etc., and to note the increasing strength of the pulse.

The patient should be closely watched for symptoms of overdosage. An injection of too much blood may cause pulmonary edema and death. The symptoms of overdosage are distress about the heart, headache, backache, pains in the legs and a short, sharp cough. The latter symptom, particularly, indicates that only a limited amount of blood should be injected following it in order to avoid the danger of overdosage.

The method of injecting the blood will be the same as that given under "Intravenous Infusion."

INTRAVENOUS INFUSION

An intravenous infusion or injection consists in the introduction of a solution into a vein. Infusion comes from the word *"fundere,"* to pour, and *"in,"* meaning into.

Conditions in which an Infusion is most Commonly Given:

1. In hemorrhage to restore immediately the volume of blood to normal, and to maintain the normal blood-pressure. This increased volume and pressure mechanically stimulate the heart and increase the supply of blood to the vital centers in the brain.
2. In shock and collapse to stimulate the circulation.
3. In post-operative conditions or in diseases such as cholera to restore the volume of blood and supply fluid to the tissues depleted by vomiting, purging and perspiration, etc.
4. In toxemia to dilute the poisons, to flush the kidneys and carry away the poisons.

In severe shock or collapse sometimes small amounts of a solution containing adrenalin are given. Adrenalin contracts the blood vessels and raises the blood-pressure.

As the fluid is injected directly into the blood stream it affects immediately the blood, the heart, the brain, and all the tissues of the body, so that the solution used, its temperature, volume and the method of introduction are all vitally important.

The **effects of an intravenous infusion** will depend upon whether the volume of blood has previously been decreased or not.

1. When the volume has been reduced by a severe hemorrhage, by persistent vomiting or excessive purging, etc., the effect is to increase the volume of blood, raise the blood-pressure, and stimulate the heart and circulation. Dr. Crile states that an infusion of saline also shortens the coagulation time of the blood and therefore helps to check bleeding, so that it is valuable to replace blood lost and may be safely used whether a hemorrhage has stopped or not.
2. When the volume of blood has not been decreased by hemorrhage, etc., a saline infusion has little, if any, effect on the blood-pressure, because, as explained by Dr. Bastedo, "in normal animals the tendency of the blood to regain its normal condition is so pronounced that almost as soon as an infusion is begun the mechanisms for regulation are started. As the result of increased pressure in the capillaries there is an immediate outpouring of weak lymph, and this is followed by elimination of liquid through the intestines and kidneys (Starling), so that in half an hour not only will the volume of the blood have returned to normal, but its constituents will have regained their proper relative proportions" (Crile).

This explains its use in toxemia, in uremia, in pneumonia, in diabetic coma, and its value in relieving thirst, and supplying nutrition in all cases where tissues are in immediate need.

The **solutions** used are: 1. *Normal salt solution.*—This contains 0.9 per cent. of sodium chlorid. Even slight variations from this strength may be dangerous. Sodium chlorid maintains the proper osmotic relations between the cells and the fluids in the body, but while it is safely and very commonly used, it does not supply other salts—calcium and potassium—necessary to the tissues. The conclusions drawn from many experiments (Howell) are that *sodium* maintains the proper osmotic relations between the cells and fluids of the body. *Calcium* stimulates the heart muscle. *Potassium* is essential to maintain the rhythmical beat or contraction and relaxation of the heart.

2. *Locke's Solution.*—This contains sodium chlorid 0.9 gm.; potassium chlorid, 0.042 gm.; calcium chlorid, 0.024 gm.; sodium bicarbonate 0.03 gm.; dextrose 0.1 gm., and distilled water sufficient to make 100 c.c. This is the best solution because it contains the necessary salts and is alkaline and nutritive. It, therefore, supplants blood which may have been lost (or withdrawn because impure), and it supports the heart.

3. *The Ringer-Locke Solution.*—The above formula with the dextrose omitted.

4. *Ringer's solution* contains sodium chlorid 0.7 per cent. (normal for frogs, etc.) with potassium and calcium chlorid.

5. *Dawson's solution* contains sodium chlorid 0.8 per cent. with sodium bicarbonate 0.5 per cent.

In diabetic coma, a 4 per cent. solution of bicarbonate of soda is sometimes given intravenously to neutralize the acidity or to increase the alkalinity of the blood and thus relieve the acidosis to which the coma is due.

In the very emaciated, in pneumonia, in gastric ulcer, carcinoma, and operations on the alimentary tract a 10 per cent. glucose solution is sometimes given intravenously to supply the tissues with nourishment in a form that can be quickly utilized to produce heat or energy.

To understand the effects of these solutions and to appreciate how vitally important it is that they should be accurately prepared, it is necessary to recall the uses of salts in the body, the behavior of fluid in the body—the processes of filtration, diffusion and osmosis—and the nature and effects of isotonic, hypotonic, and hypertonic solutions.

Diffusion.—All fluids (or gases) when brought into contact or when separated by a permeable or semi-permeable membrane tend to seek an equilibrium, that is, to become solutions having an equal specific gravity or osmotic pressure or, in other words, containing equal proportions of the substances in solution. This process is called *diffusion.* For instance, if a solution of salt or sugar (which passes readily through membranes) is separated by a membrane from water, the water will readily pass through the membrane and the salt or sugar will also pass through but more slowly so that in time the bulk of the solution and the proportion of salt or sugar will be equal on either side of the membrane. The passage of molecules of water through a membrane is called *osmosis.* The passage of molecules of salt or sugar, etc., through a membrane is termed *dialysis.* When there is a forcible passage of materials through membranes due to differences of mechanical pressure, the process is termed *filtration.*

Throughout the body there are aqueous solutions separated by membranes. For instance, the walls of the capillaries (an endothelial membrane) separate the blood from the lymph which bathes and nourishes the tissue cells; the epithelial lining of the lungs separates the air in the air sacs from the blood in the capillaries; the epithelial lining of the kidney tubules and the lining of all secreting glands separate the blood and lymph from the fluids which they secrete or excrete, and the lining of the stomach and intestines separates the digested food and other products from the blood and lymph. Through these membranes water and solids pass, impelled by the necessity to equalize their osmotic pressure. In addition to the processes described must be mentioned the selective capacity of the cells, the power to select or reject substances brought to them in solution. This process is not understood.

The absorption and assimilation of food and oxygen, the secretion of glands, the excretions from the body and the life and activities of the cells all depend upon these processes. Whatever interferes with the equilibrium of the body fluids interferes with the functions and endangers the life of the tissues.

If, therefore, a solution is injected into the blood stream, in which the proportion of salt is greater or less than that of the blood or lymph, this equilibrium will be disturbed and the tissues and blood cells greatly damaged or destroyed.

If the solution injected contains an equal percentage of salt, it is said to be *isotonic* with the blood and no disturbance of osmotic pressure occurs. If it contains a larger percentage of salt, it is called a *hypertonic* solution. This will cause the blood to abstract water from the tissues, thus depriving the cells of necessary fluid, producing great thirst, loss of vitality, or even death. The plasma of the blood will contain a greater percentage of salt than the red blood cells, therefore water will pass from these cells to the plasma, causing the blood cells (the oxygen carriers of the blood) to shrink, shrivel or become crenated. If the cells are not destroyed equilibrium will later be reëstablished.

If, on the other hand, the solution injected contains a lower percentage of salt than the blood, it is called a *hypotonic* solution. The blood plasma will be more dilute than the fluid within the blood cells and water will pass from the plasma to the cells, causing them to swell and burst, setting free the hemoglobin. This destruction of red cells is called *hemolysis* and the process is called *laking the blood.* Fluid from the blood will also quickly pass out through the walls of the congested capillaries into the kidneys, the intestines, and into the tissues. If not eliminated fast enough by the kidneys, etc., a general edema will result, with edema of the lungs, which may prove fatal.

The effect of these solutions, varying in osmotic pressure, may be readily understood by thinking of an illustration familiar to all. When prunes are purchased at the grocery store, we see that the outside skin or membrane is wrinkled or shriveled—

it has become crenated. This is because water has been extracted from the prune in order to preserve it (bacteria cannot live without moisture). Before cooking the prune, it is put to soak in water and soon the wrinkles disappear, the prune swells up, and the skin may rupture, due to the absorption of water (osmosis). The prune contains substances, in a very concentrated solution, not contained in the water, which is therefore a hypotonic solution. We see also that the water slowly becomes discolored and if we taste it, it will have the flavor of the prune, showing that solids passed out through the membrane (dialysis). This is exactly what happens to the blood cells or any cells when a hypotonic solution is injected into the blood stream. Again, prunes, or seeds, or fruit of any kind exposed to dry air become shriveled because they contain more moisture than the air so that water will pass through their skin or membrane in the effort to reach an equilibrium. This is the effect on the blood cells or tissue cells when surrounded by a hypertonic solution, one in which the amount of water in proportion to the amount of salts in solution is less than that in the cells or, more correctly speaking, one in which the amount of salts in proportion to the amount of water is greater than that in the cells.

Dangers Involved in an Intravenous Infusion.—It is evident, then, that this treatment is accompanied by considerable danger to the patient, and it has been reported that "several cases of death have occurred from the use, by rectum or intravenously, of concentrated stock solutions of sodium chlorid in mistake for normal saline" (Bastedo).

There is also the danger of injury to the vein followed by phlebitis with thrombus formation and embolism, the introduction of bacteria causing septicemia, and of the introduction of air, and of foreign matter causing a very serious reaction endangering the life of the patient. This reaction is best described by Dr. Hare as follows: "As the injection is given the pulse begins to improve, the respirations are deeper and less hurried, and if fever is present the temperature usually falls. The patient is evidently better but soon enters a critical stage, particularly if the water has not been properly prepared, which may come on in from two to thirty minutes. There are sometimes a violent chill, a strong, rapid pulse, and in the course of three-quarters of an hour a flushing of the skin, followed by profuse sweat. The respirations may be labored. The urinary flow is also increased, and sometimes water escapes from the bowel. These symptoms rarely occur if freshly distilled water is used." "Recent researches have shown that many of the untoward effects which follow injections are due, not to the entrance of the fluid, but to the fact that the water, even if sterilized by boiling, contains the toxic products of bacteria or fungi which are primarily present in the water. The water should therefore be distilled instead of boiled and used as soon after distillation as possible."

The *temperature* of the solution should be from 110° to 118° F., heat being a valuable stimulant.

The *amount* of solution given will depend upon the condition of the patient, the purpose for which the treatment is given, or the effect desired. In some cases 200 to 500 c.c. may be given and, again, from one to five pints may be slowly introduced, according to the necessities of the case. (Brewer.)

The Procedure.—*Preparation of the Patient.*—The veins into which the injection is given are the median cephalic or the median basilic, in front of the elbow, which is usually the largest, the most prominent and nearest to the surface. To prepare the part the following articles will be needed: a dressing rubber to put under the arm to protect the bed, sterile towels to cover the rubber and the immediate area around the elbow, a tourniquet (to apply around the upper arm to shut off the return of blood by the superficial veins making the veins at the elbow prominent), and disinfectants to sterilize the skin. When applying the unsterile tourniquet see that the loose ends are directed upward so that they will not be in the way or contaminate the area or any sterile article. A good light is also absolutely essential.

The *instruments and utensils* needed will depend upon the method used. The solution may be poured from a graduated glass into a glass funnel connected by rubber tubing, etc., to the infusion needle or it may be made to flow by gravity or siphonage directly from a glass flask through the rubber tubing, connecting tip and needle, etc., into the vein. The latter method will be described under "Hypodermoclysis" on page 605.

When the first method is used the articles required will be the glass graduate containing the solution and a sterile thermometer to test the temperature, a glass funnel, rubber tubing with a small metal connecting tip on the end to fit into the needle and having a glass connection in the rubber tubing through which air bubbles in the solution may be detected, also a clamp to shut off the flow, infusion needles, sterile cotton pledgets, a paper bag and basin for soiled pledgets or instruments, a sterile dressing and adhesive or bandage to retain it. If the arm is fat, the veins embedded or collapsed, it may be necessary to incise the skin and expose the vein. For this will be needed, in addition, a hypodermic loaded with cocain 2 per cent., a scalpel, an aneurysm needle, artery clamps, catgut, probe, scissors, needle holder, dressing forceps, suture silk and needles.

Method of Procedure.—After the needle is inserted in the vein, the tourniquet is loosened. Air is expelled from the tubing and while fluid is running the tube is attached to the needle. The injection must be given very slowly, the funnel being held from one to three feet above the head. Dr. Hare advises one foot above the arm and states that at least thirty minutes should be used in injecting as much as a quart. Where a flask is used (second method) the nurse must see that the solution does not drop low enough to allow air bubbles to enter the tubing, and that the temperature of the solution is maintained by adding, if necessary, hot solution. She should also watch the patient's color, pulse, and breathing, and keep a record of the amount of solution given. This is charted with a report of the effect noted upon the patient.

The procedure is conducted under the most sterile aseptic precautions. The doctor wears gloves, and everything, except the dressing rubber and tourniquet, must be sterile.

This treatment is *contraindicated* when *edema* is present. As explained previously, when the volume of blood is not reduced, an infusion has a tendency to cause edema. If the fluid cannot pass out quickly from the capillaries into the tissues, an injection of fluid into the veins may cause dilatation of the right side of the heart and pulmonary edema, which might be fatal.

It is *indicated* when rapid action is desired, when the circulation is poor, and when the tissues are unable to absorb fluid. When this is not the case the same effects may ultimately be secured either by giving the injection into the tissues (hypodermoclysis), or into the rectum (proctoclysis). Effects by hypodermoclysis are secured more rapidly and directly than by proctoclysis.

HYPODERMOCLYSIS

A hypodermoclysis is a method of supplying fluid to the body by injecting normal saline, or Locke's solution, into the subcutaneous tissues. The word "hypodermoclysis" is derived from *hypo,* meaning beneath, *derma,* the skin, and the Greek word *klysis,* already explained. It is also derived from the word "clysmian," which means having the character of a deluge or to drench.

The **therapeutic uses** of a hypodermoclysis are much the same as those described under an intravenous infusion, so need not be repeated.

The **effects of the treatment** are also much the same, the difference being chiefly in the rapidity with which the results are obtained. The fluid injected is rapidly absorbed by the blood vessels, especially after a hemorrhage, with results identical, although not so rapidly obtained as when given by intravenous injection. It is said that a quantity of liquid equal to four times that of the normal amount of blood may be passed directly into the veins without producing a rise of blood-pressure and that usually an increased flow of urine from the kidneys occurs within fifteen minutes after fluid flows into the subcutaneous tissue. (Dr. Hare.)

The treatment, like an intravenous injection, is *contraindicated* in any form of edema.

The *solutions* used are usually the same as when given intravenously. Sometimes, however, fluids, such as a solution of bicarbonate of soda, suitable for intravenous administration, are not given by hypodermoclysis as they cause chemical injury to the tissues and skin.

The *temperature* of the solution is 120° F.

The *amount* of solution may be from one to two pints, given slowly. "It is not safe to infuse a greater quantity of liquid than one dram to each pound of body weight in each fifteen minutes, as, if this amount is exceeded, the accumulation of the liquid in the system is so great that the tissues become drowned, because the kidneys cannot excrete the liquid fast enough."

Site to be Prepared.—The solution may be introduced beneath the skin of the abdomen, below the breast, in the thighs, buttocks, or in the axillary line. The site chosen is most important and should always be where there is sufficient fat to allow for absorption of fluid without undue pressure upon the skin. The needles should never be inserted where the fluid may be injected along the course of large blood vessels. For this reason some object to the anterior surface of the thighs, the area being over the femoral vein. Unsatisfactory results may interfere with the patient's walking.

The *articles* required for the treatment will be a rubber dressing sheet, sterile towels to drape the area, disinfectants for the skin, sterile absorbent cotton, the sterile solution, thermometer, flask, tubing (with glass connecting tip to detect air bubbles) and needles. Sometimes injections are made in two places simultaneously; in that case a glass T connecting tip with two short pieces of rubber and two needles will be required. A sterile dressing—a collodion dressing or gauze and adhesive—a paper bag and kidney basin will also be required. The kind of flask used varies. The flask should be graduated. Sometimes an open sterile flask into which the solution is poured and allowed to run out by gravity through the rubber tubing, etc., attached is used. Sometimes the flask containing the sterile solution ready for use (when heated) is used. This flask is provided with a rubber stopper with two holes into which glass tubes are inserted. One tube extends into the solution. To this tube the rubber tubing, etc., is attached. The other tube does not extend into the solution. To this a bulb is attached by means of which pressure is exerted on the solution which is in this way forced through the other glass tube into the rubber tubing and needles, etc., attached. Other more or less convenient methods are in use, but the principles are much the same.

Method of Procedure.—The flask should be held or secured about two feet above the patient. The doctor connects the sterile tubing, etc., disinfects the skin, and inserts the needles. The nurse's duties are to prepare the patient, to assist the doctor as required, to watch the rate at which the fluid is absorbed, to see that the fluid does not become too low, and as it may run in very slowly, to see that the temperature is maintained. As the fluid enters a slight local swelling develops which disappears as absorption takes place. Very gentle rubbing will aid the absorption.

When this treatment is given, the condition of the patient is frequently critical. The greatest care must be taken to avoid exposure and chilling. The nurse should watch the patient's color and pulse closely.

In charting, note the amount of solution given and the effect of the treatment on the patient's pulse, appearance, and general condition.

WOUND INFECTION

Another important duty of the nurse in the care of a patient following an operation is to provide, as far as possible, conditions which promote healing of the wound, to watch for any symptoms of infection, inflammation, congestion and suppuration, and to exclude all conditions which predispose to it.

Conditions which Promote Healing and Prevent Suppuration.—A wound is a "solution in the continuity of soft tissues." This means an injury to and death of many tissue cells to which, as explained in Chapter XX, the tissues respond, in accordance with a fundamental biological law, by an inflammatory process. *This process should be thoroughly reviewed* in order to have a proper understanding of wounds and their treatment. As explained in this foregoing chapter, a surgical wound, if infection does not already exist, is an incised, aseptic wound which should heal by *primary union* or *first intention;* that is, the cut edges should grow together or heal with the slightest degree of inflammatory reaction and with the least requirement for the formation of new tissue. Because of the absence of a disfiguring scar, the surgeon speaks of it as a "beautiful" incision. This is the goal which Nature, the surgeon, and the nurse all aim to achieve.

If healing is to take place in the above manner a nurse must see that no restless movements of the patient, exertion or strain, as in coughing or vomiting, etc., cause a rupture of the sutures with tearing open of the wound. She must also see that the dressings are not displaced, exposing the wound or even the area around the wound. The next essential is the proper nutrition, which means a rich supply of normal blood freely circulating in the part. The patient's diet, his surroundings, general health and comfort have a very marked influence on the nutrition and circulation in the part and it must not be forgotten that the mental attitude also influences to a marked degree the metabolism and functions of the whole body.

The effect of sugar in the blood (diabetes), or increased acids (acidosis), and anemia from malnutrition, old age, or lowered vitality from any cause has already been explained. Any interference with the circulation, whether from high blood-pressure, arteriosclerosis, or pressure from tight bandages or adhesive straps, etc. (which either limits the supply of blood or causes congestion), interferes with healing and may result in death of tissue, infection and suppuration. When the circulation is free, bacteria, which are always present in every wound, no matter what precautions are taken, are easily overcome by the tissues and healing is rapid. These bacteria, however, at other times harmless, multiply rapidly when in the presence of dead tissue or fluid in a congested area. Even the pressure from sutures drawn too tightly in the wound is sufficient to cut off the circulation and is likely to result in infection and suppuration. Wounds in tissues where the blood or lymph supply is free, as in the face, heal much more rapidly than in tissues such as tendons, ligaments, or cartilage, etc., where the blood supply is limited. For the same reason epithelium (the skin, etc.) heals more rapidly than deeper structures such as muscles and fascia, etc., so that superficial wounds heal more rapidly than deep wounds. This is chiefly due to the fact that epithelial tissue has such a wonderful power of regenerating itself or multiplying and forming new tissue while muscular tissue has very little.

Wounds in young people heal more rapidly than in the aged, in whom the circulation is poor and the vitality lower. Wounds in old people must, therefore, be watched with particular care and in any case when a bandage, splint or cast is applied to an extremity (where the circulation is apt to be poor) a nurse must watch for discoloration, pain, cold sensation, and swelling indicating poor circulation.

An intact nerve supply is equally important to the nutrition of the part so that pressure must never be so great as to cause loss of sensation or numbness. The position of the part must be such as to promote good circulation. We have already learned the effect of pressure, poor quality of blood, abnormal constituents in the blood, poor circulation and paralysis in both the cause and delayed healing of bedsores. The same applies to any wound. In some cases, such as ulcers on the leg, a tight bandage applying pressure is used in order to prevent congestion in a dependent part and to aid the return circulation of venous blood. In an abdominal wound or dressing the nurse must note increased pain and distention which causes the adhesive straps to become so tight that the pressure may be sufficient to limit the blood supply or cause congestion in the wound. Increased fluid in the part, the action of bacteria, inflammation and suppuration, will cause increased tenderness, an elevated temperature, a rapid pulse, and an increased leucocyte count (leucocytosis). These are the symptoms a nurse should watch for. They may be due to a *stitch abscess*, that is, inflammation and a mild suppuration about one or more stitches. If, however, the above symptoms are not observed or are ignored and the suppurative process is allowed to continue, the accumulation of fluid and pus will cause the sutures and tissues to slough, allowing the wound to burst open with a free discharge of pus. It may cause ligatures to slough and slip from the blood vessels leading to a secondary hemorrhage. The bacteria and poisons may also be absorbed into the blood stream and cause a general sepsis which may prove fatal. Such a wound must heal by *indirect union.*

This process, and the complications which may occur in the healing of such wounds, are discussed in Chapter XX. A thorough review is necessary in the study of surgical diseases.

CHAPTER XXXIII

THE PREVENTION, TREATMENT AND NURSING CARE IN POST-OPERATIVE COMPLICATIONS

In addition to the discomforts and other serious conditions, directly due to the operation itself, which have been discussed in the previous chapters, dangerous complications sometimes follow in its train if not carefully guarded against. These complications will be discussed in the present chapter. They may result from an infected wound as in cellulitis, septicemia, pyemia, erysipelas, tetanus, and peritonitis, or they may bear no relation to the wound, as in post-operative pneumonia, renal complications, thrombo-phlebitis and pulmonary embolism.

Such diseases are not only always very serious in themselves and often fatal, but when following in the train of an operation, they attack the patient before his body has had time to recover from the injury, shock, loss of strength, and lowered resistance due to the operation.

Careful, intelligent nursing and the early recognition and reporting of symptoms will often prevent the development of these dangerous complications. In the care of patients following operations nurses should consider it their particular province and should take a special pride in seeing that their patients have a speedy, uneventful recovery.

Complications Resulting From Infected Wounds

Cellulitis.—When the suppurative process infiltrates the surrounding tissue the condition is called cellulitis. The organisms which produce cellulitis are more commonly the streptococci, the staphylococcus aureus or albus and the colon bacillus. Where the tissues are loose the infection spreads very rapidly. Cellulitis may result from the spreading of infection already present in a post-operative wound or from the invasion of the wound by bacteria. When not associated with a post-operative wound it may be due to infection following an injury to the tissues resulting from friction, heat or cold, counterirritants, injections of irritating drugs, and snake or insect bites. Even a pin prick, if it introduces the germs, may be followed by a serious and even fatal cellulitis. When it occurs in patients where the circulation is poor as in marked arteriosclerosis, or when the metabolism of the tissues is interfered with and the blood is abnormal as in diabetes, or when the nutrition of the tissue is poor as in spinal cord lesions, cellulitis may be rapidly fatal. Sometimes a patient's resistance is poor to special kinds of infection.

The *symptoms* are both local and general. The local symptoms are those of an acute inflammatory process—heat, redness, swelling, intense throbbing pain, and loss of function. The general symptoms are due to absorption of toxins or septic material and are the general symptoms which accompany fever or sepsis. The local symptoms often resemble the early symptoms of erysipelas so that it is difficult to make a diagnosis until the demarcation in erysipelas is well established. Cellulitis may be mistaken for erysipelas or vice versa. Both spread very rapidly. When there is doubt as to the diagnosis the patient should be put "on precautions" as in the treatment of erysipelas. (See Erysipelas, page 612.)

The *treatment* usually consists in the application of moist dressings or a continuous bath where possible and surgical interference by incision and drainage.

Septicemia, Pyemia and Septic Intoxication.—*Septicemia* or acute general sepsis is the result of the entrance, growth, proliferation or general flooding of the blood stream with pyogenic organisms.

Pyemia is septicemia in which the organisms have gained a foothold here and there in the tissues of the body in which they deposit colonies or suppurative foci of infection (abscesses) from which bacteria are from time to time poured into the blood stream.

Septic intoxication or toxemia is due to the absorption of toxins from the suppurating wound or abscess.

Sapremia is a general poisoning due to the absorption of poisons due to the action of putrefactive organisms on dead tissue. An example of this would be puerperal sepsis due to the action of organisms on a portion of the placenta allowed to remain in the uterus after childbirth. The tissue being cut off from the blood supply dies and so forms an ideal lodging place for bacteria.

The *organisms* which most commonly cause septicemia are the streptococcus pyogenes and the staphylococcus aureus or albus. These bacteria are always present in the mouth, throat, nasal passages, etc., and on the skin, and the lowered resistance of the patient due to the operation invites an attack. Whatever lowers the general resistance of the patient or the resistance of the wound tissues predisposes to septicemia.

The streptococci cause a general septicemia or they may attack the walls of the blood vessels, forming infected thrombi from which, as they disintegrate, the bacteria are shed into the blood. An example of this would be septicemia due to sinus thrombosis following a mastoidectomy. This thrombus at first may form a plug preventing the invasion of the general blood stream with bacteria but as it disintegrates (perhaps not until the end of a week or more) shreds laden with bacteria pass into the stream, giving rise to the chill, high temperature, etc., of general sepsis. Streptococci, which grow in chains, cause a diffuse inflammation. Wherever they gain a foothold they "tend to spread diffusely through the tissues, causing havoc wherever they go."

The staphylococci, on the other hand, cling together in clusters, so concentrate their attack at various points where they produce abscesses with an acute inflammatory reaction around them. They cause osteomyelitis and produce small abscesses on the surface and throughout the organs of the body—the muscles, heart, liver, and kidneys, etc. In a general infection these organisms are discharged in the urine, which is, therefore, a source of danger.

Other organisms—the pneumococcus, gonococcus, bacillus coli communis, bacillus pyocyaneus, and others, may be the cause of septicemia.

The *symptoms* usually begin on the third post-operative day with chilly sensations or a definite chill, headache, and backache, and the patient feels very miserable in general. The temperature rises to 102°, 105° or 107° F. The mouth is dry, the lips parched, the tongue coated and the patient is very thirsty. The high fever may be continuous but more often there are marked remissions, rising after a chill (probably due to a pouring out or flooding of the blood stream with fresh bacteria) and falling to or below normal during the cold sweats which occur. The pulse is rapid and, as the lining and muscles of the heart and blood vessels become affected, soft, small and easily compressible. As the kidneys become affected the urine is scanty. Red cells are destroyed, causing the marked pallor, and bacteria plug the capillaries with emboli, forming petechial spots. While the patient's resistance lasts there is a marked leucocytosis which falls as the general prostration increases. In fatal cases restlessness and delirium alternate with stupor which finally passes into coma before death. The local symptoms are pain and acute inflammation about the wound.

Treatment and Nursing Care.—The local treatment consists in a thorough drainage, cleansing and irrigation of the wound or focus of infection. When the symptoms are due to toxemia they subside with the local treatment but when due to general sepsis they are not relieved by the local treatment. In septicemia and pyemia the prognosis is very grave but patients have recovered with proper treatments and *skilled nursing* care. Transfusions are given to supply antibodies and to increase the patient's resistance. Hypodermoclyses and proctoclyses are given to stimulate the heart, supply fluid to the tissues, relieve thirst, dilute the poisons, stimulate the kidneys and to flush the poisons and bacteria out of the system. Water is also given freely by mouth. Nourishing fluids are given by mouth or when nausea and vomiting prevent, nutrient enemata are given. Everything is done to keep up the patient's strength and resistance and to cause the elimination of the poisons. Fresh air and sunlight are essential. Everything must be done to relieve discomfort—the headache is relieved by an ice-cap, the backache by massage and by rubbing with alcohol, chills by the application of external warmth, the high fever, restlessness, delirium or stupor by cool sponging. The mouth is kept moist and clean, perspiration is removed by sponging, the gown and bed linen are kept dry and clean.

Skilled nursing care will do much toward keeping up the patient's strength and preventing him from being overwhelmed by the invasion of the bacteria.

A patient with septicemia or pyemia should be isolated from other surgical patients and every precaution taken to prevent the spread of infection. The nurse must avoid or take great care of even the slightest abrasion which she, herself, may have, for bacteria may enter by the most minute abrasion, even too small to be visible, and cause a general septicemia even before the local symptoms develop.

Erysipelas is an acute communicable disease, characterized by a rapid spreading inflammation, which usually attacks the skin but which may spread to the mucous membrane of the throat, larynx, or middle ear, etc. It is caused by the streptococcus pyogenes, usually called the streptococcus erysipelatis, which accounts for the diffuse, spreading inflammation. It always begins in a wound or abrasion, most commonly on the head or face, but also on the abdomen and other parts. The organisms are constantly present in the nose and sinuses, which is said to account for the frequency with which erysipelas occurs on the face following a slight abrasion or an operation on the mastoid cells or facial sinuses.

Symptoms.—The streptococci invade the tissues and occur in large numbers in the lymph channels of the skin. The wound becomes hot, tender, and red; the skin becomes red, elevated, smooth, tense and edematous with an advancing, irregular, red, glistening and sharply defined margin which marks the advance of the streptococci. As the army keeps advancing it leaves behind only dead organisms so that the inflammation gradually subsides and the color fades in the devastated region passed over. Suppuration, however, sometimes occurs. Where the skin is loose, as about the eyes, the tissues may become very edematous and enormously swollen—the skin may become necrotic or great blisters may form. Where the skin is tight, the spread of the infection is checked. The constitutional symptoms are also marked and are the same as in general sepsis—chill, fever, rapid pulse, etc., leucocytosis, and frequently delirium.

Patients usually recover from the erysipelas but may die from septicemia or pneumonia.

Treatment and Nursing Care.—The disease is self-limited—the organisms die as they advance—so must run its course. The temperature usually falls in four or five days. The patient is isolated as the disease is very infectious. Local applications are made, such as ichthyol or cold wet dressings of boric acid, which do not cure but which give great comfort. The nursing care is the same as in any septic or toxic condition and is directed toward relieving all possible discomforts and to building up the patient's strength and resistance.

Erysipelas is very apt to recur. No immunity seems to be developed. Like all coccal infections—pneumonia, gonorrhea, etc.—once having gained a foothold, these organisms are very difficult to dislodge so that one attack predisposes to future attacks.

Tetanus occasionally occurs as a complication following surgical operations. The tetanus bacillus is sometimes present in the intestinal canal of both men and animals. Some are in this way thought to be carriers. In abdominal operations in which the intestines are bruised, roughly handled or exposed and chilled so that their resistance is lowered or when the wound is contaminated with fecal material, tetanus may develop if the tetanus bacillus is present. The catgut used has also occasionally been a source of infection. Catgut is made from the intestines of sheep and so may be contaminated with the tetanus bacillus.

The normal habitat of the tetanus bacillus, however, is in the soil, so that accidental wounds contaminated with dirt, etc., are more apt to be infected. Tetanus will, therefore, be discussed under accidental wounds.

Peritonitis.—Before one can understand the post-operative conditions in which peritonitis is likely to develop and, therefore, know when to particularly guard against it; or before one can recognize and understand the symptoms, or realize the seriousness of the disease or understand the treatments used both to prevent and relieve peritonitis, one must recall certain facts about the peritoneum.

The first point to remember is its enormous extent, its surface if spread out being almost equal to that of the skin. Infection, therefore, may spread very rapidly and extensively but this is, to some extent, limited by the anatomic divisions formed by folds of peritoneum and the arrangement of the organs, etc., and also by the ability of the peritoneum to form adhesions and thus wall off or localize any inflammatory process. This is accomplished within a few hours by the pouring out of a fibrinous exudate which glues two inflamed surfaces together and which, if necessary, is later changed into dense, strong, permanent fibrous adhesions. This ability to form adhesions is greater in some regions than in others, particularly in the pelvic region, so that infection or a collection of pus may be quickly walled off and its spread limited.

This explains why a patient is placed in Fowler's position following an operation for an appendiceal abscess, etc., as it causes the fluid or pus, if present, to gravitate to the pelvis, where it can be localized and drained. There is also another reason for putting a patient in Fowler's position—the pelvic peritoneum has a much greater resistance to and is less susceptible to infection and its power of absorption is less than in other regions. The peritoneum contains many lymph glands so has an enormous power of absorption, particularly in the peritoneum of the upper abdomen, so that by keeping the infection away from this region the danger from the absorption of bacteria and toxins resulting in septicemia or toxemia is lessened. The healthy peritoneum has a wonderful resistance to bacteria but when exposed to chilling, drying, rough handling or pressure during an operation or to irritation due to bile, stomach and intestinal contents or to strong antiseptics or to the presence of blood or foreign bodies such as ligatures, sponges or instruments accidentally left in, its resistance is greatly lowered and its power of absorption is decreased so that bacteria, at other times harmless, may stagnate, multiply, and cause peritonitis.

This power of absorption is due to the numerous lymph channels whose business it is to carry away waste products, bacteria and other foreign substances. The direction of the flow may be reversed so that the peritoneum may pour out a large amount of lymph or inflammatory exudate—this accounts for the rapid accumulation of fluid in this cavity. The pouring out of the exudate forms adhesions, prevents toxemia, dilutes toxins and helps to flush out the cavity. Drainage tubes inserted or any foreign body acts as an irritant and causes an increased flow, therefore aids in localizing the infection and in drainage. Plain gauze is the most irritating and causes the greatest outflow, but is seldom used alone or, if used, is generally removed within twenty-four hours because if left in too long the fibrinous exudate infiltrates its meshwork, binding and sealing it in so that it merely dams back the pus, and makes it very difficult, painful, and injurious to the tissues in removing. If left in a week it may easily be removed because by that time the tissues around it will have broken down with the formation of an abscess so that the gauze lies loosely in a pocket of pus. This reverse flow of lymph, etc., causes a loss of body fluids which must be supplied in the treatments.

Another important factor to remember is that the parietal peritoneum (lining the abdominal wall) contains many sensory nerves while the visceral layer does not, so that inflammation of the parietal layer causes extreme pain and tenderness. This accounts for the extreme tenderness of the abdomen, so great, sometimes, that the least pressure of the bedclothes may be unbearable. It also accounts for the hard, board-like rigidity due to the contraction of its muscles in the effort to protect the viscera within, to keep the parts absolutely at rest and so avoid pain, irritation and the spread of the infection. It also accounts for the shallow costal breathing as the diaphragm is kept quiet in order to avoid pressure, irritation or the least movement of the viscera within. Again it accounts for the position instinctively assumed by the patient—the shoulders bent and the knees drawn up to prevent any pull or strain on the abdominal muscles with increased pain.

In peritonitis the muscular coat of the intestines and its nerve plexus are involved so that paralysis results with constipation or obstruction, fermentation and putrefaction of its contents with distention or tympanites. This pushes the diaphragm up, makes breathing difficult and embarrasses the action of the heart. It also causes severe pain and strain on the sutures.

Causes of Peritonitis.—The conditions which predispose to infection or which cause a non-infective type of peritonitis have already been mentioned—exposure, rough handling, etc., perforation of an abdominal organ resulting in the presence of irritating or decomposing substances such as blood, bile, urine, and stomach contents, etc. Stomach contents are irritating but may be free from pathogenic organisms except when, as in cancer, hydrochloric acid is diminished or absent. Contents of the small intestine are very irritating on account of the pancreatic juice which digests anything it comes in contact with. The contents may also be highly infectious as in typhoid fever. The contents of the large intestine always contain many bacteria and are highly infectious. *Acute septic peritonitis* may be caused by perforation in appendicitis (contents from the large intestine), in typhoid and gastric ulcer, by rupture of an abscess of the liver, kidneys, Fallopian tubes or ovaries, by inflammation spreading from other tissues, and by infection of an abdominal wound. The organisms which most commonly cause septic peritonitis are the streptococcus pyogenes, the staphylococcus, colon bacillus, gonococcus, typhoid bacillus, tubercle bacillus and the pneumococcus.

Symptoms.—The first is constant pain. Note its location and character. When due to a perforation, it is usually very sharp and sudden, and accompanied by persistent vomiting, usually projectile in type and requiring no effort on the part of the patient. The vomitus consists first of stomach contents then, as the intestines become paralyzed and obstructed, regurgitation and vomiting of fecal matter occur. There is always tenderness and rigidity of the abdomen—note its location and whether spreading or not; other symptoms are a rapid, weak, thready, compressible pulse; an elevated temperature (in advanced cases it may be subnormal); rapid, shallow respirations; a rising leucocytosis; hiccough, due to irritation of the diaphragm, distention, due to paralysis and fermentation of intestinal contents; a characteristic position—knees drawn up; prostration and symptoms of general toxemia—face pinched, anxious-looking, drawn and blue, tongue coated and tremulous, sordes on the teeth, restlessness, mind active and alert, sleeplessness, and finally there may be delirium, stupor or coma.

The *treatment* is suggested by Nature's method and attempt to relieve pain, to localize and prevent the spread of infection by keeping the viscera absolutely at rest and by getting rid of irritating contents within; to relieve pain, etc., by position; to dilute poisons and flush out the cavity by the pouring out of fluids, and by efforts to increase the resistance (leucocytosis).

To limit peristalsis and so keep the parts at rest, absolutely *nothing is given by mouth,* not even water, and at first enemas, or even the insertion of a rectal tube, are avoided. To get rid of irritating contents, the stomach is frequently washed out by lavage. This relieves pain, vomiting, distention, restlessness, and sleeplessness and limits peristalsis. To relieve pain and localize the infection, an ice-bag or ice-coil is usually applied. This must not be left on too long as it may limit the blood supply and lower the resistance. Sedatives are also given to relieve the pain, restlessness, and sleeplessness; morphin, which also limits peristalsis, may be ordered.

The position is very important. It must be such as to localize the infection in the pelvic cavity, promote drainage and relieve strain on the abdominal muscles and sutures. Fowler's position is used by many surgeons. The patient sits upright, properly supported and prevented from slipping down, the knees are flexed and supported—this can best be accomplished with a Gatch frame. Remember that this is a very trying position. A nurse will have to use every art to make the patient comfortable and to prevent bedsores. Remember also that this position causes increased work for the heart. Also see that the shoulders are properly covered, for the limited action of the diaphragm, in addition to the usual causes of post-operative pneumonia, predisposes to this condition. In this position, when distention is present, there is less pressure on the diaphragm and therefore less difficulty in breathing. The patient may lie on his back or on his side if the pillows are comfortably arranged —comfort is extremely important in conserving the patient's strength and resistance. Frequent sponging and rubbing with alcohol give great relief. Fowler's position does not aid in drainage because the pus will be in the pelvis and would have to run uphill to the wound (drainage is accomplished by the drainage tubes, etc., used) so sometimes to aid drainage the patient is turned on his face, comfortably supported with pillows, so that the pus will naturally run out. Some surgeons do not use Fowler's position at all but turn the patient on his face immediately after the operation.

A hypodermoclysis, proctoclysis and, if necessary, an intravenous infusion are given to supply the body with fluids, to relieve thirst, to keep up the resistance, to dilute and eliminate toxins and to flush the kidneys. Colon irrigations and enemata are given to relieve distention. A cradle is used to relieve the weight of the bedclothes when they cause discomfort.

The dressing to the wound should be changed frequently, both to avoid irritation to the skin and tissues and the odor which, if the patient is not too prostrated, is very distressing and adds to his discomfort. A little aromatic spirits of ammonia or eau de cologne sprinkled on the bed is both stimulating and refreshing. Some surgeons do not use dressing at all over the wound in drainage cases but use the open treatment; that is, a cradle is used to prevent contact of the bed linen, etc., with the wound (an electric light is sometimes attached for warmth and comfort), and a large absorbent dressing is placed snugly at the patient's side to absorb the pus as it drains from the wound. The skin is protected by sterile vaseline or zinc oxid, etc. If the feeling of the contact of clothing is necessary to sleep, large dressings are applied to the wound during the night.

As in the care of all post-operative conditions, all causes of discomfort and unrest either mental or physical should be removed. As in all abdominal operations all causes of intra-abdominal tension should be avoided in order to relieve pain and strain on the sutures—coughing, sneezing, vomiting, distention, retention of urine, sudden movements or straining at stool, etc.

Diet.—When anything by mouth is allowed, it should be given with the utmost care to avoid the danger of vomiting and distention. Water is usually given for twenty-four hours, then, if no unfavorable symptoms occur, small amounts of fluids containing carbohydrates are given to prevent acidosis. Acid intoxication sometimes develops after an operation, particularly when the patient is deprived of food for some time. In order to supply energy the patient is then obliged to try to burn up his own fat and when this difficult form of metabolism is incomplete, it results in the accumulation of fatty acids or acidosis. If carbohydrates are given they will be used to form energy and so prevent acidosis.

The *care of the mouth* is important in all post-operative conditions but particularly so in all abdominal operations.

Post-Operative Pneumonia

Pneumonia is a serious complication which occasionally develops after an operation, although with proper care before, during, and after the operation it can always be prevented. Where there is no pre-existing cause it is the result either of a poor anesthesia or of poor nursing. Where there is a predisposing factor such as inflammation of the upper respiratory tract—coryza or bronchitis, or disease or congestion of the lungs as in tuberculosis and some forms of heart disease,—ether anesthesia is avoided. It depresses the respiratory center, increases the local irritation and congestion and so forms a suitable soil for the invasion and growth of bacteria.

The prognosis in pneumonia in the old or very young is bad and in all cases it adds greatly to the discomfort of the patient. The coughing causes severe pain and a serious strain on the sutures of the wound and in every way makes the outlook less favorable.

The *preventive measures* to use before the operation are to see that the mouth, nose and throat are well cleansed; to avoid exposure and chilling of the body during the preparation of the patient and in all other treatments; to see that old people particularly have plenty of bedclothing so that they will not be chilled by the scanty cotton nightgown and lack of underclothing which they may have been accustomed to; and to see that the patient is quite warm when going to the operating room.

A prolonged anesthesia is always to be avoided when possible.

The *preventive measures* while the patient is under the anesthetic and later are, to keep the mouth, nose and throat free from mucus, vomitus, or blood, and to prevent their inhalation. Avoid exposure. Be particularly careful to see that the patient is well covered when coming from the warm operating room—the chest and the extremities particularly must be kept warm. A padded jacket as chest protector is usually worn under the gown. Avoid exposure during restlessness. Ether causes a dilatation of the blood vessels in the skin and perspiration. Chilling of the surface of the body would cause these vessels to contract, thus driving the blood to the interior and causing congestion of the lungs and other internal organs. Allow no damp clothing near the patient such as gown or bed linen wet with perspiration. See that the room is quiet and warm (68° F.), with plenty of sunlight and fresh air but no drafts.

Particular care must at all times be taken with old people. They must not be allowed to lie long on their backs, must be turned frequently, placed in a semi-recumbent position, given a backrest and allowed up as soon as possible. All patients should be turned as often as their condition permits. Particular care must also be taken after operations on organs high up in the abdomen, such as the stomach, liver, and gall bladder, because the handling, exposure and irritation of the upper peritoneum and the diaphragm predispose to pneumonia. These patients are usually propped high up in bed. No tight binder or strapping, etc., should be allowed to limit the movement of the lower ribs as this also predisposes to pneumonia. Loss of blood also predisposes to pneumonia.

The *symptoms* which suggest pneumonia are rapid respirations, an increase in the pulse rate, an elevation of temperature, and frequently a cough. They usually appear on the third or fourth day.

Post-operative pneumonia is usually bronchitic or bronchopneumonic in type although lobar pneumonia occasionally develops. The grouping of the sputum usually shows group IV pneumonia, that is, a mixed infection—the streptococcus, micrococcus catarrhalis and influenza bacillus may be present. These are organisms commonly found in the nose and throat.

The *treatment* in addition to the preventive measures already given consists in keeping the air warm and moist—steam inhalations give great comfort; the use of sedatives (codein) to relieve the cough and strain on the sutures; water in abundance to drink, and the prevention of distention. Local applications to the chest, such as mustard pastes and cupping, also give relief. The patient should be kept absolutely quiet, free from worry or excitement.

The treatment for lobar pneumonia is the same as that outlined in the chapter on medical diseases.

RENAL COMPLICATIONS

Suppression, Anuria, Uremic Coma

Following the administration of a general anesthetic the kidneys may fail either totally or partially to secrete urine. Ether and chloroform are irritating poisons which must be eliminated from the body. They irritate all the tissues they come in contact with. A large amount is eliminated by the kidneys, so they may become irritated. Inflammation sets in and, as you remember, one of the symptoms and results of inflammation is loss of function. The function of the kidneys is to secrete urine. Also as a result of the anesthetic the kidneys are forced to eliminate other irritating, abnormal waste products which result from incomplete metabolism. You will remember that the anesthetic causes depression or checks the functions of every organ and all the processes of oxidation. When these processes are complete relatively harmless substances are formed which do not irritate the kidney cells, such as carbon dioxid, water and urea, etc. When incomplete, only partially broken down or combined, the substances formed, such as ammonium compounds from protein, acids from fats and sugars, are harmful, so that the work of the kidneys is not only increased but the products eliminated are very irritating and may result in loss of function.

A nurse must, therefore, be particularly on her guard to watch the amount of urine and the urinalysis following an operation and to note immediately any symptoms of suppression—scanty urine, of low specific gravity, headache, dizziness, dimness of vision, nausea, poor appetite, restlessness and sleeplessness, and puffiness under the eyes. Finally, the patient may become drowsy and weak, with muscular twitchings and delirium and in fatal cases convulsions and coma may develop before death.

The treatment and preventive measures consist in the avoidance of all exposure, the administration of forced fluids by mouth, hot colon irrigations, proctoclysis with potassium acetate (a diuretic), imperial drink and other diuretics and diaphoretics and the application of counterirritation to the lumbar region, such as mustard pastes, hot flaxseed poultices, fomentations or dry cupping. If anuria develops, hot packs are given to increase the elimination of waste products by the skin, thus protecting the body and resting the kidneys. These treatments are entirely in the nurse's hands. Their success and the recovery of the patient depend largely upon the skill with which they are given.

ACIDOSIS

Acid intoxication or acidosis sometimes develops after an operation. This is due to the accumulation of fatty acids—β-oxybutyric and diacetic acid, etc., resulting from the incomplete metabolism of fats. The patient must have some source of energy so that when nourishment is withheld after the operation the body attempts to burn up its own supply of fats.

The *symptoms* are dyspnea or rapid breathing, poor appetite, persistent nausea and vomiting.

If not relieved the condition may become acute, resulting in coma and possibly death.

The Treatment.—To prevent acidosis and to supply nourishment when the patient cannot be given fluids by mouth in sufficient quantity, a glucose solution is usually given by proctoclysis or in urgent cases it may be given intravenously. This is to supply the tissues with sugar, which can easily be converted into energy. As soon as possible carbohydrates are given in the diet to prevent further metabolism of the body fats.

THROMBOPHLEBITIS AND PULMONARY EMBOLISM

During an operation blood vessels are cut, bruised, clamped and injured in various ways. When blood vessels are injured or if foreign matter—air, bacteria, shreds of tissue, etc.—enter the blood stream, the blood tends to clot. When the small blood vessels are cut, the blood clots to check the bleeding. During an operation, therefore, there may be numerous blood clots formed. A clot within a blood vessel during life is called a *thrombus*.

Thrombi most frequently form in the veins where the blood flows more slowly than in the arteries and most commonly in the left saphenous or femoral veins. They are more frequent after abdominal operations, especially on the uterus and in operations about the rectum. They usually occur about the second or third week after operation.

Thrombi form on the walls of the vessel and, if undisturbed in this position for some time become firmly fixed to the wall of the blood vessel. Connective-tissue cells which grow into the thrombi finally replace them completely with fibrous tissue. This is called *organization* of the thrombus which renders it relatively harmless. New channels may be formed in it for the passage of blood so that instead of flowing through one channel it flows through several smaller channels or entirely new channels may be formed by anastomosing branches. If, however, violent movements or rubbing or rough handling, etc., dislodge the thrombus before it is organized it will be carried in the blood stream into the larger veins to the right side of the heart and thrown violently into the pulmonary artery and then into one of its branches too narrow to pass, where it becomes tightly wedged, completely obstructing the flow of blood.

If this occurs in a large pulmonary artery instant death usually results. A thrombus which is dislodged and carried in the blood stream until it becomes lodged in a vessel which it completely obstructs is called an *embolus*. Pulmonary embolism is one of the most distressing accidents which may occur during convalescence, occurring usually when least expected, without any previous warning or time for treatment because there have been no symptoms of thrombus formation. It may occur suddenly when sitting up in bed or in a chair or walking around for the first time.

The *symptoms* of thrombophlebitis are local tenderness and swelling, or the whole limb may be swollen and painful with a sensation of weakness and weight. If the clot is infected there may be a slight chill, a rapid pulse, and an elevated temperature.

The Treatment.—Free movements after an operation help to prevent the formation of thrombi. In old people, particularly, or in patients with a weak heart, lowered vitality or varicose veins, long rest in bed tends to cause the formation of thrombi. If formed, the patient must be kept very quiet, in bed in the recumbent position, and the part must be kept absolutely at rest for from five to six weeks. Even very slight movements or exertion may be sufficient to dislodge the thrombus. No straining of any kind, such as straining at stool, should be allowed. On no account should the part be rubbed. The limb may be wrapped in cotton and elevated or elevated on a soft pillow to aid the return flow of blood and a hot-water bottle placed at the feet. A cradle should protect the part from the bedclothes. An ice-bag applied to the part relieves the inflammation and pain. When the acute symptoms subside a hot-water bag gives relief. Sedatives are usually necessary for the severe pain. Particular care must be taken to avoid the slightest movements after the third week, when the clot is likely to disintegrate. An infected thrombus always disintegrates so that the whole or shreds of it may be dislodged.

CHAPTER XXXIV

NURSING IN OPERATIONS REQUIRING SPECIAL CARE IN THE AFTER-TREATMENT

There are a number of operations which, either because of their nature and location or the complications which may develop, require special nursing care in the after-treatment. Some of these will be discussed in the present chapter. The special things to be considered are, the nature of the operation and what to watch for; the position, freedom of movement and comfort of the patient; the diet, general hygienic care, care of the wound, the prevention of complications, and special treatments required.

Operations Upon the Jaw or Mouth

All wounds about the face heal rapidly because of the free blood supply. In order to avoid disfigurement, primary union is extremely important. Great care must be taken, therefore, to avoid infection of the wound as it would interfere with healing and might leave an unsightly scar, causing contraction and deformity. In wounds of the face watch for symptoms of injury resulting in paralysis or loss of sensation. In operations on the mouth or jaw, in which the wound penetrates the mucous membrane, it is difficult to avoid infection as the mouth is never free from bacteria. The *care of the mouth* is for this reason extremely important in all cases. It should be thoroughly cleansed every two hours with an antiseptic solution, taking great care not to damage the sutures. The nose should also be kept clean.

The Diet.—In order to keep the mouth clean and the parts absolutely at rest until healing or granulations have formed, the patient is usually fed liquid food either by rectum or by gavage. This is necessary also in operations on the tongue (such as excision in carcinoma), or on the jaw, in which the muscles of the tongue are injured and the patient is unable to swallow. He will learn to swallow later by using other muscles. When the patient is given fluids by mouth through a drinking tube, the fluid should be allowed to enter the unaffected side and the mouth should be carefully rinsed and cleansed afterwards.

Operations on the tongue may cause such intense swelling (with edema of the glottis) as to obstruct the breathing so that it is most important to watch the patient's color and breathing.

Watch for hemorrhage, either primary or secondary, in operations about the nose, mouth or jaw, particularly in infected wounds. The arteries are large and anastomose freely so that hemorrhage is likely to be severe and difficult to control. Infected thrombi may form and be forced out of the vessels, resulting in a severe hemorrhage. An ice-bag is usually applied to the face or to an external wound to prevent a hemorrhage and to check suppuration if infection is present.

The head should be kept turned over on the side in operations on the mouth to allow all secretions, etc., to flow out easily.

Harelip.—In an operation for harelip there is always considerable shock and loss of blood. The treatment for these conditions must always be included in the after-care. Infection of the wound must be avoided, as it will cause sloughing of the sutures and undo all the delicate work done by the surgeon. *The nose and mouth must* be kept scrupulously clean. For older children a mouth wash of normal saline may be used very gently every three hours, but no mouth cleansing is used for infants. Sometimes a few drops of 15 per cent. argyrol are placed in the nostrils every three hours. The wound, lips and nostrils are sometimes painted with a 10 per cent. colloidal silver solution or with iodin. The wound must be kept free from crusts by gently sponging with boric acid. Sterile albolene may be used to keep the skin soft and free from crusts. The part must be kept absolutely quiet, if possible. A baby must be kept from crying and his hands must be secured. Sometimes tincture of opium is given to relieve pains and prevent crying. *Feedings* are given with a sterile medicine dropper. Nothing but water is given, usually, for the first six to twenty-four hours; normal saline is given by rectum. Watch for hemorrhage. All causes of discomfort, unrest, excitement or sleeplessness, such as soiled diapers, damp clothing, cold, or too much heat, hunger, gas in the stomach or intestines, playing with or talking to, etc., must be avoided.

Cleft Palate.—In this operation there is apt to be more shock, a greater loss of blood and greater danger from hemorrhage. The care is the same as in the above.

HYPERTHYROIDISM

The *pre-operative treatment* in hyperthyroidism is extremely important. There are two types of hyperthyroidism, the first being the hyperplastic (exophthalmic goiter) type, and the second, the toxic adenoma of the thyroid. In the past few years there has been a complete change in the pre-operative treatment of hyperthyroidism due to the discovery of the beneficial effects of iodin, particularly on the hyperplastic type. The beneficial effect on the toxic adenoma is said to be very doubtful.

The early recognition of *symptoms* of hyperthyroidism is extremely important.

The use of *basal metabolism tests* has often given many surgeons a much clearer indication of the most suitable time for operation; and by the pre-operative use of iodin in the form of Lugol's solution in doses of from 5 to 10 drops three times a day, the metabolism has often been greatly reduced. Too much stress cannot be laid upon the fact that the promiscuous use of iodin for all pathological conditions of the thyroid gland is one of the most grave problems in modern medicine.

Exophthalmic goiter is, by some surgeons, always considered a hospital case when diagnosed, with a view to surgical interference as soon as possible. Medical treatment is given for a period varying from a week to a month depending upon the case. During this period the basal metabolism is tested and the iodin treatment continued until the patient's condition is favorable to operation.

The *Post-Operative Treatment.*—There are two outstanding serious post-operative conditions which may occur, one of which is failure of the heart muscle due to the toxicity of the thyroid secretion over a long period of time. The extreme tachycardia makes the operation particularly dangerous. The second condition of acute toxemia is due to the excessive secretion and absorption of the thyroid secretion following manipulation of the gland and manifesting itself by extreme high temperatures. During the operation the system is flooded with the thyroid secretion. Either an operation for ligation of the thyroid vessels or a thyroidectomy may bring on acute symptoms of toxemia—extreme tachycardia, a very high temperature, 104° or 105° F., and nervous symptoms with sometimes violent excitement. Heart failure may result. These symptoms are said to be present in a mild degree in two-thirds of the cases, but usually subside in two or three days. Another chief cause of post-operative death is pneumonia. Shock may also be severe and occasionally hemorrhage. These patients are always very poor surgical risks because the gastric disturbances from which they have suffered and the increased metabolism, due to the hyperthyroidism, make them emaciated and depleted.

The *treatment* is directed toward preventing toxemia, heart failure, shock, or pneumonia, and in watching for hemorrhage. The patient should have absolute rest in a quiet, dark room. Sandbags are placed at the sides of the head and neck to keep the parts at rest and prevent strain on the sutures. Care must be taken to keep the nose, mouth and throat free from secretions and to prevent them from being aspirated into the lungs. Some surgeons turn the patient on the face, with the body elevated by pillows, to allow the free outflow of secretions, thus preventing them from entering the lungs or the stomach and causing discomfort. Elevating the foot of the bed prevents shock and aids in the outflow of secretions. There must be no strain on the sutures.

Repeated injections of normal saline solution by hypodermoclysis are frequently given to relieve shock, to supply fluids to the tissues, and to combat the toxemia. Every effort is made to lessen the thyroid secretion, to prevent its absorption and to cause it to be eliminated from the body. It is extremely toxic to the nervous system, heart and kidneys. It may cause an acute and fatal nephritis. Fluids are forced in every way to dilute the toxic secretions and flush them from the system, by intravenous injections, hypodermoclyses, proctoclyses, colon irrigations, and later, forced fluids by mouth. An ice-bag is applied to the neck to check the formation and absorption of the thyroid secretion.

The extreme tachycardia is only benefited by the use of large doses of morphin.

Morphin is also given to prevent restlessness when recovering from the anesthetic, and the patient is usually kept under the influence of either morphin or bromids to prevent restlessness, nervousness, or excitement. A nurse must remember that her patient is very easily excited and her emotions very easily upset. By studying her patient and by suggestion, tact and skill she may prevent these symptoms of acute toxemia. Every effort must be made to soothe, quiet, encourage, and steady the patient, and to prevent mental excitement, worry, or fatigue, as well as all causes of physical discomfort, unrest, or exertion. When the toxemia is acute and the temperature, etc., does not subside, cold or ice-packs and sponges are sometimes given to reduce the temperature, quiet the heart and relieve nervousness and excitement. Too much stress cannot be laid upon the value of these cold applications.

When conscious (if there is no further danger from shock or vomiting, etc.) the head, neck and shoulders may be made comfortable with pillows. As soon as possible the surgeon usually allows the patient to be propped up. This prevents pneumonia, lessens the strain on the sutures, and makes breathing more comfortable. The irritated mucous membrane due to the ether and the tight constricting dressing make breathing sometimes rather difficult. Steam inhalations are sometimes ordered and give great comfort.

Every effort must be made to build up the patient's general condition by sleep, rest, fresh air, nourishing diet, plenty of water, and other hygienic measures. No tea or coffee or anything irritating to the nervous system should be given. The patient is allowed up as soon as possible, frequently within a few days. She must not be allowed to become fatigued.

A Breast Amputation

Following an extensive breast amputation there is apt to be considerable pain and discomfort in the arm, shoulder, and chest, and also in breathing. Pillows should be arranged to support the arm and shoulder, to make them comfortable, and to prevent strain on the sutures.

All operations on the chest predispose to pneumonia and, in addition, the pain and discomfort limit the motion of the chest wall, which also predisposes to pneumonia. The surgeon usually orders the patient to be propped up in bed as soon as possible. Then, as the wound heals, to prevent contraction, with the resulting danger of a stiff arm and loss of function in the shoulder joint, the patient is encouraged to make slight movements of the shoulder joint, the arm being left free from the dressing for this purpose. Slight movements of the arm are allowed soon after the patient becomes conscious.

After the third or fourth day the surgeon usually allows the patient up in a chair. In this position the arm, shoulder and chest can be made more comfortable. The weight of the arm should be well supported. After a few days the patient is allowed to feed herself and is encouraged to use the arm so as to exercise the joint. At the end of a week she may do her own hair.

After an operation resulting in such an extensive scar and deformity the patient is apt to be sensitive and depressed. She should be kept as bright, cheerful and hopeful as possible, and never allowed to brood over her misfortune. Give her something else to think about and something to do which will exercise the arm and shoulder. Remember that a stiff shoulder joint is a very real misfortune and a serious handicap, and that the only way to prevent it is by proper exercise.

Abdominal Operations

After all abdominal operations, with the necessary exposure and handling of the peritoneum and viscera, and, in some cases, a prolonged anesthesia or considerable loss of blood, there is apt to be more or less *shock*. This danger is particularly great in operations on the organs of the upper abdomen—the liver, gall bladder, and stomach, because of the great celiac plexus and abundant nerve supply in the region of the lesser curvature of the stomach, and because of the close relation to the vital organs, the heart and lungs.

Pneumonia is also more apt to follow operations on the abdomen, particularly on the upper abdomen, due to the exposure and handling of the diaphragm and upper peritoneum. No tight binder or adhesive strapping should be allowed to limit the movement of the lower ribs, as this predisposes to pneumonia.

Vomiting is more apt to be prolonged and *distention* is more apt to occur because of the exposure and handling of the viscera with resulting paralysis of their muscular walls. The function of the whole alimentary tract may be interfered with and there may be considerable delay before it can resume its normal functions. Special care must therefore be observed in resuming and selecting the diet, also in giving either enemas or cathartics.

A hernia may follow an abdominal operation in which the union is weak. *Intra-abdominal tension* from any cause—vomiting, coughing, sneezing, distention, retention of urine, straining at stool, restless movements—must be avoided, as it causes a strain on the sutures and predisposes to hernia. The patient's position must allow the abdominal muscles to relax to prevent pain and strain on the sutures. She may lie on her back with the shoulders elevated, the thighs and knees flexed and supported, or she may lie on her side, with chest, thighs, and knees flexed. *Infection* of the wound must be avoided, as it may cause a weak union and predisposes to hernia. All sources of discomfort must be avoided as they cause restlessness, with a strain on the sutures.

Adhesions may follow abdominal operations. To prevent adhesions and also to prevent pneumonia, the patient should be moved at least two or three times during the day. This also helps to prevent distention. To prevent *peritonitis,* when there is local infection, care must be taken to localize the trouble by limiting peristalsis and all restless movements and by placing the patient in Fowler's position.

When there is drainage either from an abscess or from any organ, the position must be such as to promote free drainage.

The skin must be protected from discharges from an abscess or from any of the abdominal organs. The secretions of all the glands—the bile, gastric juice, pancreatic, and intestinal juices—are very irritating to the skin and delay the healing of the wound. Any discharge of the secretions from the small intestines is particularly irritating, as it contains the pancreatic juice, which digests whatever it comes in contact with. Discharges from the large intestines are also very irritating and contain pathological and putrefactive germs which may contaminate the wound and cause peritonitis.

Disagreeable odors are very distressing to the patient (and other patients) and have a depressing effect on the mind and, therefore, on the whole system. When discharges from any part of the body have a foul odor, the dressings should be changed frequently, the bed linen kept sweet and clean and the patient unembarrassed by the odor. A little cologne water or aromatic spirits of ammonia on a wipe, which the patient can smell, or a little sprinkled over the bedclothes is very refreshing. Red wash (which contains compound tincture of lavender) or a small amount of a deodorizing agent may be sprinkled on the external dressing, binder or bandage, and on the bedclothes; formalin, carbolic acid, creolin, or naphthalin solution may be used.

Dressings should be changed every two or three hours when the discharge is foul as in a fecal fistula, and the skin should be kept clean and protected to prevent eczema. Where there is inflammation with suppuration and drainage in a wound, hot moist dressings give great relief and promote free drainage.

Closed wounds free from infection or drainage are usually left undisturbed for from seven to ten days as any unnecessary interference predisposes to infection.

The abdominal binder is frequently applied after abdominal operations for comfort and support and to give the patient a feeling of security. It relieves her mind, for it is natural for her to feel that the wall is not quite strong at first.

HERNIOTOMY

After a herniotomy, particularly, every precaution must be taken to avoid a strain on the sutures. The patient should be moved, to prevent pneumonia, adhesions or distention as in other operations, but with extreme care. In some cases, however, where a weak union is feared, the surgeon may not allow the patient to be moved for some time, sometimes for two or three weeks. In all cases the thighs are flexed slightly and the knees supported to relax the abdominal muscles and prevent strain on the sutures. All restless movements must be avoided. Sometimes it is necessary to bind the thighs together and in children or violent patients sometimes a few turns of plaster-of-Paris bandage are applied to protect the wound.

In male patients, following a hernia, the scrotum must always be supported. This is done to relax the muscles and prevent strain on the sutures and to prevent congestion in the part which predisposes to infection and other complications.

OPERATIONS ON THE STOMACH

Gastrostomy.—This consists in the formation of an artificial fistula through the abdominal wall into the stomach and the insertion of a rubber tube or soft rubber catheter through which food may be introduced into the stomach. The fistula may be formed in such a way as to produce a valve-like action, preventing any leakage of gastric juice, and also the rapid, spontaneous closure of the wound when the fistula is no longer necessary.

The operation is performed so that food may be introduced as high up in the alimentary tract as possible when a stricture or obstruction of the esophagus, such as in carcinoma, prevents food from being swallowed.

The tube through which food is to be introduced is clamped off between feedings to prevent any escape of gastric juice. This juice is very irritating owing to the hydrochloric acid and enzymes in it. It prevents healing of the wound and may cause eczema. It does not infect the wound because its acidity is destructive to germs. If gastric juice escapes around the tube the parts must be cleansed, protected with an ointment, and the dressings changed frequently.

Feeding the Patient.—The method of feeding the patient varies. Some surgeons keep the stomach absolutely at rest for the first twelve hours after the operation, during which time the patient is given nutrient enemata every four hours, alternating with normal saline by enema or the Murphy-drip method. Then nothing is given but sips of water until the second or third day, when such fluids as albumin water, peptonized milk and vichy in small amounts (ounces two) alternating every two hours, making feedings due every hour, are given. Then the amounts are gradually increased until at the end of a week (healing has taken place) six to eight ounces of fluid are given. Gradually very carefully selected soft diet is given until after two or three weeks a more liberal diet, both in amount and variety, is permitted. Rectal feedings are discontinued usually when soft diet is allowed.

Some surgeons, on the other hand, believe that the sooner after the operation the patient is supplied with nutrition, the sooner normal digestion and peristalsis will be resumed. Feedings are begun as soon as the anesthetic wears off. Sometimes regular fluids are allowed or sometimes only selected fluids. Peptonized milk is usually given—five ounces every two hours—because it is nourishing and partly digested. Its nutritive value is usually increased by adding dextrose, lactose or whisky, one-half ounce, and sometimes in addition one egg.

The Method of Feeding.—All that has been said in a previous chapter regarding the effect of the emotions, of pleasurable sensations, bright, cheerful, pleasant surroundings, enjoyment and interest in eating, a good appetite, and everything which promotes a good appetite, on the secretions, and on the digestion and assimilation of food, has an added importance when feeding the patient in this artificial manner. Everything possible must be done by the nurse to create these favorable conditions. At its best, to the patient, it is a poor substitute for the lifelong custom of eating in the normal way with the natural pleasure and satisfaction which to some people are the chief enjoyments of life. *Try to make it as natural as possible,* otherwise pouring the food into the stomach may fail to cause the gastric juice to flow and so will only cause discomfort. These patients are nearly always already emaciated and weakened from being unable to swallow food for a prolonged period. Some surgeons allow the patient to hold the food in the mouth, to masticate it, if solid, before placing it in the funnel. The sensation of taste and the presence of the food gives pleasure, stimulates the appetite and the secretion of both saliva and gastric juice. Warn the patient not to swallow the food. Place a screen around the bed to avoid the depressing effect of embarrassment.

When feeding the patient, a funnel is attached to the rubber catheter. The food is allowed to run in very slowly. Sometimes, according to the doctor's order, about one-half funnel full of water is allowed to run in both before and after the feeding. The patient should remain quietly at rest after feedings. When the tube is to be removed after feedings, after all the food has passed into the stomach, the tube is left in position a few minutes to avoid starting up peristalsis. It is then gently removed.

Whether the tube is removed after, and left out between feedings or not, depends upon the method of operation. When the Janeway method is used the tube is left in the fistula for the first five or six days after the operation, that is, until healing has sufficiently advanced. After this the tube is removed, cleansed, sterilized and only introduced when feeding is necessary. Surgeons who use this method say that the tube is removed between feedings for several reasons—for cleanliness, and the comfort of the patient, and because, if left in permanently the tube becomes eroded by the gastric juice and the fistula tends to dilate, allowing the escape of gastric juice. Normally the valve-like action and the pressure and contraction of the muscular walls of the abdomen prevent its escape. If the fistula tends to close or become smaller when the tube is removed, it is left in longer or not removed so frequently. It is never left out more than twelve hours. The fistula closes rapidly after the tube is finally removed, that is, when no longer necessary. Many surgeons, however, do not use this method of operation and the tube is not removed for ten days or two weeks or longer, depending upon the case. A nurse should never remove the tube without special orders from the surgeon and should prevent any restless movements or disturbance of the dressing which might cause its accidental removal. If the tube should be removed or slip out by accident, the nurse should call the surgeon immediately to reinsert it. If not replaced at once the fistula may close and it may be very difficult or impossible to reinsert it.

A **jejunostomy** is a fistula formed into the small intestines for the same purpose as a gastrostomy or when absolute rest of the stomach is desired. The care in feeding is the same as in gastrostomy.

A **gastro-enterostomy** is performed in malignant or benign pyloric stenosis and in certain cases of gastric and duodenal ulcer. A **pylorectomy** may be performed for the same conditions—the after-treatment is the same in each.

The *after-treatment* consists in relieving shock and loss of blood, in supplying the body with fluid and nourishment, in preventing toxemia due to acidosis resulting from starvation, in keeping the part absolutely at rest until healing takes place, and in preventing nausea, vomiting, distention, coughing, pain, and all discomforts causing either mental or physical unrest.

The principal points to remember are, that there is a fresh wound in the wall of the stomach and of the small intestines which will take several days to heal; that the walls of the stomach are richly supplied with blood vessels, and that in such an extensive operation there is apt to be considerable bleeding into the stomach.

The blood accumulates because the stomach is paralyzed by the ether and the operation, and putrefaction of the blood is rapid as it is an excellent medium for germs. The stomach dilates increasing the shock and interfering further with the action of the heart and lungs. The blood and the increased secretions, due to the ether, cause nausea and vomiting; the muscular walls are paralyzed so that nothing passes out, and as there is no absorption nothing should be allowed to pass in.

A lavage may be necessary to remove the blood and secretions in order to relieve nausea and vomiting. Vomiting is always very exhausting and the patient is always in a weakened condition before the operation because the ulcer or growth is usually one of long standing, so that the patient has been poorly nourished for months or years. Rest, sleep, nourishing diet, fresh air, and freedom from worry, etc., are extremely important after the operation. Morphin is usually given to relieve pain and insure rest and sleep.

The Treatment.—Nothing is given by mouth (not even water) for from six to eight hours after the operation and sometimes even longer. A supply of fluid to the tissues, however, is essential.

Hypodermoclyses may be ordered to relieve shock and to supply the body with fluid. Normal saline or normal saline with glucose solution may be given by infusion or by proctoclysis to supply the tissues with fluid and carbohydrates to prevent toxemia due to acidosis.

The *feedings* vary with the patient's condition and the presence or absence of nausea and vomiting, etc. The following is an example of a method frequently followed: Nothing by mouth for eight hours, then water ʒ i is given every hour.

On the first day: Water ℥ ss alternating with albumin water every hour.
On the second day: Peptonized milk ℥ ss
Albumin water "
Water "
Broth "
} alternating every hour.
On the third day: Beef juice ℥ i may be added to the above list of fluids.
On the fourth day: Feedings increased to ℥ v and ice cream allowed.
On the fifth day: Regular fluids every two hours.
On the sixth day: Jelly, junket, custard, gruel.
On the eighth day: Scraped beef, baked potato, creamed soups allowed.
On the ninth day: Selected soft solids.

When solids are allowed the patient should be instructed to eat slowly and to masticate thoroughly. No very hot or cold fluids, etc., should be allowed and no tea or coffee, as they tend to increase hyperacidity. The patient is advised to avoid large meals, to eat small amounts frequently, and a modified ulcer diet (hyperacidity) is usually advised for at least one year. Particularly after an operation for the removal of a gastric ulcer, care must be taken to avoid increased acidity, as there seems to be a tendency to a recurrence of the ulcer. Hyperacidity of the stomach contents is usual in gastric ulcer.

In carcinoma, hypoacidity is the rule and for this reason the healing of the wound should be watched closely because the absence of hydrochloric acid allows the growth of bacteria so that contamination of the peritoneum and wound is much more apt to cause peritonitis or wound infection than in a gastric ulcer where the acidity is high.

Distention is particularly serious after a gastro-enterostomy so must be watched for and prevented. The application of a flaxseed poultice with the insertion of a rectal tube in the rectum and the administration of pituitrin, which stimulates the contractions of the intestines, are frequently used to relieve it.

OPERATIONS ON THE INTESTINES

The care is chiefly directed toward the prevention of peritonitis, the prevention of intestinal paresis with distention or obstruction, the prevention of adhesions, securing proper drainage when necessary, the care of the wound, and the proper use of diet, enemata or cathartics.

Discharges from the small intestine are very irritating to the skin and wound because of the presence of the pancreatic juice, but operations on the large intestines are more serious because of the danger of soiling the peritoneum or the wound with the contents which contain many bacteria which may cause peritonitis or general sepsis.

The prevention and treatment of these conditions have already been discussed.

Hemorrhoids.—The *after-treatment,* as in all operations on the rectum and anus, requires skilled and conscientious attention.

The factors to remember in the treatment are the *danger of severe hemorrhage,* primary or secondary, the *danger* of *infection,* the *constant severe pain,* probable *retention of urine,* and the *need for absolute rest and cleanliness.*

Hemorrhage from the rectum may be very severe as the blood supply is very free. The bleeding may occur shortly after the operation or after a lapse of several days due to the sloughing of the tissues and erosion of a blood vessel. Watch the dressing for staining and also watch for symptoms of shock or collapse, because if the bleeding occurs into the rectum and the sphincters are contracted the blood will not show externally, but will accumulate in the rectum, giving the symptoms of an internal hemorrhage. The patient may ask to use the bedpan, as contents in the rectum normally produce this desire.

The treatment for a hemorrhage consists in keeping the patient very quiet and warm, elevating the foot of the bed, reinforcing or changing the dressing and applying pressure. Inserting ice may help to control it. The surgeon should be sent for immediately. The patient should be prepared for examination when the surgeon arrives and whatever he may be expected to need should be in readiness. The hemorrhage is usually controlled by packing the rectum with tampons saturated with an astringent solution or with vaseline. The articles required will be a good light, sterile gloves, wipes, sponges, dressings, forceps, a rectal speculum, a sterile solution, etc., for irrigating, and the tampons for packing. The dressings are held in place with a T binder.

Pain is always severe and constant, because of the many nerves about the anus, and must be relieved. It makes the patient restless, prevents him from sleeping, and lowers his resistance. Opium suppositories are usually inserted directly after the operation, which relieve pain and keep the part at rest by limiting peristalsis. Hot moist dressings relieve inflammation, swelling and pain. An ice-bag applied to the part gives great relief.

Retention of Urine.—Pain is often caused or increased by retention of urine resulting from paralysis of the muscular wall of the bladder which is controlled by the same nerves which supply the rectum and anus. Retention should always be watched for and must be relieved either by voiding or catheterization.

The Care of the Wound.—The wound must be kept at rest and absolutely clean. Fluid diet only is allowed and the bowels are kept closed for the first four days. After urination the parts should be carefully cleansed and a dry sterile dressing applied and held in place with a T binder. Dressings must be securely fastened to prevent displacement. The wound should be watched for signs of inflammation. A rise in temperature and an increase in pulse rate should suggest infection of the wound. Do not disturb the wound more than is absolutely necessary, as this predisposes to infection. On the fifth day, to soften fecal matter and cause a movement of the bowel without effort, one dram of compound licorice powder or one ounce of castor oil is usually given by mouth, followed later by an oil enema given through the tube inserted in the rectum at the time of the operation. This tube is later expelled with the movement. Sometimes a simple cleansing enema is given one hour after the oil enema. The parts are thoroughly cleansed and a fresh sterile dressing applied. Care and gentleness must be used in all treatments and dressings. The bowels are then kept open with daily movements, if necessary by an enema or mild laxative, followed by cleansing and dressings. Light diet is allowed with food leaving little residue. No straining of any kind should be allowed. When the patient sits up he should be given a rubber ring for comfort and to relieve pressure.

In an *incision of the rectum, prolapse of the rectum,* or a *rectal abscess,* the necessity for extreme care is even more important. Where there is drainage the dressings should be changed frequently as the wet dressings make the patient very uncomfortable and restless. Elevating the head of the bed promotes free drainage. Hot moist dressings also promote free drainage. The odor from sloughing tissues and from soiled dressings is always most distressing to the patient and is to be avoided by absolute cleanliness and frequent change of dressings. When practicable, the hot sitz bath removes odors and promotes drainage, cleanliness and healing.

In a prolapse of the rectum, the foot of the bed is elevated.

In all cases the diet should be nutritious, easily digested, leaving little residue so that there will be little or no stool.

Acute Appendicitis and Sequelæ.—*Importance of Early Recognition and Prompt Treatment.*—It is extremely important that nurses, and even the laity, should recognize the signs and symptoms of acute appendicitis in order that treatment may be prompt and dangerous sequelæ may be prevented. The dangers are gangrene and perforation, abscess formation and the rupture of the appendix with resulting peritonitis, which is frequently fatal.

Signs and Symptoms.—The chief symptoms are colicky *pain*, beginning at first in the epigastrium, or it may be general, then localized in the right side; extreme *tenderness* and *rigidity* may be at first general, then localized at McBurney's point—"a spot about two inches internal to the anteroposterior spine of the ileum, on a line drawn from that bony point to the umbilicus," which overlies the usual point of origin of the appendix. *Vomiting* is present in almost every case. A *chill* seldom occurs. The *temperature* ranges from normal to 102° or 103° F. The absence of fever is not always a sign of the severity of the case. A normal or sub-normal temperature with a rapid *pulse* is a grave sign. The pulse is usually rapid. *Thirst* is usual. The *tongue* is coated and dry, and the *facial expression, posture,* and *respirations* are indicative of pain.

Danger of Attempted Treatment Before Diagnosis.—Such treatments as the administration of food or drink, cathartics, irrigations, or sedatives are contraindicated. The proper treatment is to keep the patient quiet, in Fowler's position, and to prevent peristalsis in order to allow the formation of adhesions and prevent the spread of the infection. Sedatives or an ice-bag applied before diagnosis mask the symptoms and so interfere. Cold after the brief stage of hyperemia also interferes with the circulation, the migration of leucocytes, the formation of adhesions, and the vital activities of cells.

The *after-treatment* has already been indicated.

Post-Operative Complications.—The two chief sources are (1) infection of the peritoneum due to rupture of the appendix, and (2) toxemia from paralytic ileus. The treatment of the latter is directed toward early relief of the obstructed bowel by ileostomy and the insertion of a loop in the small intestine, allowing for drainage until the toxemia passes. For the prevention and treatment of peritonitis see page 613.

OPERATIONS ON THE GALL BLADDER AND DUCTS

Common operations on the gall bladder are: *Cholecystotomy* (incision of the gall bladder), usually for the purpose of drainage; *cholecystostomy,* the formation of a fistula into the gall bladder for drainage; *cholelithotomy,* incision into the gall bladder for the removal of stones; *choledocholithotomy,* incision of the common bile duct for the removal of gall stones; *cholecystectomy,* excision of the gall bladder.

The chief factors to remember in the after-treatment are the danger of severe *shock* from the necessary handling of viscera in the upper abdomen; the danger of *pneumonia* from exposure and handling of the diaphragm and peritoneum of the upper abdomen; the danger from *paresis of the stomach* with dilatation and persistent vomiting following, resulting from the handling of the duodenum and pyloric region of the stomach; the danger of *adhesions* and later interference with the action of the stomach and small intestines; the danger of *hemorrhage* in jaundiced patients—the presence of bile in the blood prevents it from clotting in the normal time; the necessity for adequate *drainage* and the unobstructed flow of bile; the *irritating effect of bile* on the wound and skin.

The *treatments following the operation* may be a transfusion, infusion, or hypodermoclysis to relieve shock and loss of blood. A hypodermoclysis, or saline by the Murphy-drip method, may be ordered to supply the tissues with fluid.

The patient's position is important. He is usually propped up in bed to allow free drainage, to prevent pneumonia, to prevent pressure on the diaphragm and make breathing more comfortable. The temperature reaction, etc., is usually not so great in this position.

Extreme care must be used in the *diet*. Small amounts only of fluids are given. Lavage is given for persistent vomiting.

As the condition is apt to be one of long standing, with interference in digestion and resulting emaciation, a full diet is given as early as possible in all cases except when the stomach and intestinal tract are involved.

When drainage is the object of the operation, it must be watched with extreme care.

Usually two drains are used, one large rubber tube draining the operative site and the other small tube being placed directly in the common duct. See that the drainage tube is in the bottle and draining properly—note the amount and character of the bile discharged. The discharge may consist only of mucus from the inflamed lining of the gall bladder instead of bile. Watch the stools to see if normal in color or not. If normal it shows that the inflammation or obstruction has subsided, but if "clay-colored" it shows the obstruction is still present. Watch the color of the patient and note whether he is jaundiced or not in order to see whether the formation and discharge of bile are normal or not. Where there is drainage, protect the skin from the irritating effects of the bile. Drainage from the common bile duct is apt to be particularly irritating because of the probable presence of pancreatic juice.

The dressings should be kept dry and the skin protected with gauze handkerchiefs impregnated with an ointment such as boric ointment or petrolatum, which permits observation of the skin and wound; zinc oxid ointment tends to hide the condition.

Some surgeons do not apply a dressing over the wound at all because "a warm poultice of bile and pancreatic juice favors the digestion of tissues." When no dressing is used over the wound a cradle is used to protect the wound from the bedclothing, etc., and a large absorbent pad is placed at the side so as to receive the discharge. The position of the patient is changed frequently to prevent the discharge from flowing over the same area constantly. The discharge on the dressing is said to be more profuse and annoying at night than in the day because when the patient is fed most of the bile formed in the liver is discharged into the intestines to aid in the digestion of the food. Some surgeons, therefore, feed the patients every three or four hours during the night. Even when the "open treatment" (that is, with no dressing over the wound during the day) is used, the surgeon usually applies a large dressing for the night, as many patients sleep better with the sensation of the bedclothes in contact with the body.

Operations on the Urinary Tract

The principal operations performed are *nephrectomy,* excision of the kidney; *nephrolithotomy,* incision of the kidney for the removal of a calculus; *nephrotomy,* incision of the kidney as for the drainage of an abscess, etc., and *prostatectomy,* excision of the prostate gland (male reproductive system).

The principal factors to remember in the after-treatment are the danger of *uremia, pneumonia, hemorrhage, shock,* and *acidosis.*

The amount, character and analysis of the urine voided must be very carefully noted and recorded. The urine should be watched for the presence of blood. If the patient fails to void, catheterization is usually done to find out whether the anuria is due to retention or suppression. Headache, vomiting, dimness of vision, drowsiness, restlessness, and a high-tension, incompressible pulse, partial or complete loss of consciousness, convulsions, coma and death will follow if these symptoms are overlooked and the condition is allowed to go untreated.

To prevent suppression, particular care must be taken to keep the patient warm with extra blankets in order to prevent internal congestion, and to stimulate excretions of waste by the skin. To aid in the elimination of waste products, fluids are supplied to the tissues intravenously, by hypodermoclysis, or by proctoclysis, and hot fluids are given freely by mouth as soon as nausea ceases. Bicarbonate of soda or glucose solution is frequently added to the proctoclysis to combat acidosis. The bowels must be kept open. Saline cathartics are sometimes given for this purpose. Hot colon irrigations are often given to stimulate the kidneys, supply fluid and aid in the elimination. Drugs such as digitalis may be ordered to stimulate the kidneys and urotropin may be given as a urinary antiseptic. Benzoic acid or acid sodium phosphate is frequently given with urotropin because an acid medium is necessary to cause urotropin to break up, yielding formaldehyde, to which its antiseptic properties are due. Hot packs may be ordered if the kidneys show signs of failure.

Pneumonia is one of the dangers to be particularly guarded against. The kidneys are high up in the abdomen, directly under the diaphragm, and the posterior lobes of the lungs. Particular care must be taken after a prostatectomy, which is usually performed on old men, as all old people are particularly susceptible to pneumonia. They must be kept warm with plenty of clothing and all exposure, chilling and drafts avoided. The patient is usually propped up in bed, and the surgeon orders a back-rest and allows the patient up in a chair as soon as possible. The position should be changed frequently, but where drainage is desired the position must be such as to promote free drainage.

The dressing should be watched for staining. Where there is drainage, the amount of urine on the dressings or discharged through the tube into a bottle should be noted. The rubber drainage tube should be watched to see that it does not collapse and that pressure, etc., does not interrupt the flow of urine. Soiled dressings should be changed. Urine retards the healing of a wound and forms a good culture medium for germs, and decomposed urine is very irritating. No strong antiseptics such as iodoform or bichlorid of mercury, etc., are ever used on the wound because of the danger of absorption and irritation of the kidney in elimination.

Following a prostatectomy and similar operations on the urethra or bladder, the scrotum must be supported for the reasons already mentioned under a herniotomy.

After a prostatectomy a patient is very uncomfortable, usually suffers from severe pain, and is apt to be very restless, excitable, and often delirious. Such patients require constant attention and very careful nursing.

To prevent shock and hemorrhage the patient must have absolute rest. His general health is also extremely important. He must have rest, sleep, comfort, fresh air, and light but nourishing diet.

Operations on the Female Reproductive Organs

Operations on the pelvic organs may be followed by *shock*, *hemorrhage* and *retention of urine*. The amount and character of the urine voided must be closely watched, not only because of the danger of retention of urine due to paralysis of the bladder walls, but during the operation the bladder, or more frequently the ureters, may be injured. The ureters lie very close to the uterine artery and are occasionally accidentally ligatured or actually injured during the operation. The result would be very serious, if not fatal, if the condition were not recognized and the patient operated upon immediately to relieve it. Occasionally the rectum is accidentally injured.

Watch for symptoms of cystitis, as this condition seems to develop more frequently after operations on the pelvic organs.

Watch for symptoms of hemorrhage, either internal or external, on the vaginal dressing, particularly after a vaginal hysterectomy. Watch the urine, when the patient voids, for the presence of blood. The patient may be bleeding and the removal of the dressing and the act of voiding may cause a severe hemorrhage. Be careful in giving and removing the bedpan to cause the patient as little exertion as possible. Note any vaginal discharge following operations on the uterus, etc.

Following operations on the uterine ligaments to correct displacements (retroversion or retroflexion) of the uterus, the patient is usually required to lie upon her side inclined toward her face in order to keep the uterus, by gravity, in the antiflexed and antiverted position. Lying on the back causes a strain on the internal sutures and ligaments holding the uterus in its new position.

Following all operations, such as for ectopic gestation with rupture of the tube, in which the loss of blood has been large, the patient must have absolute rest and treatments to repair the loss of blood.

The psychic effect of the removal of the uterus or ovaries is an extremely important factor in the after-treatment. The removal of the uterus or of both ovaries deprives the patient of the possibility of having children. In many cases this has a very morbid, depressing effect on the mind, which must be counteracted if possible. "The love of children and the maternal instinct is strong in every good woman and the thought of 'what might have been' is always a saddening one." The removal of the ovaries also brings nervous disorders, hot flushes, and other distressing symptoms of the menopause. This is counteracted by the administration of ovarian extract or extract of the corpus luteum.

Vaginal dressings are necessary after such operations as a vaginal hysterectomy, curettage of the uterus, and a trachelorrhaphy. They include the necessary changing of the dressing following the use of the bedpan, the removal of packing, vaginal irrigation, and the removal of sutures. In all cases the dressing is a sterile procedure, observing the most strict aseptic precautions.

After the use of the bedpan the parts are thoroughly but gently cleansed, dried, and a sterile dressing applied, held securely in position by a T binder, which must always be scrupulously clean, and so fastened as to prevent displacement.

The removal of packing and sutures, wound dressings, and irrigations are dressings performed by the doctor. The instruments, etc., required will depend upon the dressing. The position of the patient must be both convenient for the doctor and comfortable for the patient. Frequently the patient is placed on a special examining table. The patient must be warm. No unnecessary exposure should be allowed and the patient's feelings must be considered in every way. A nurse always remains throughout the dressing. The area surrounding the parts is draped with sterile sheets. There must be a separate receptacle for soiled dressings and packing, and another basin for soiled instruments. When an irrigation is required, a warm, dry, protected douche pan is placed under the patient. It must not be so placed until the doctor is ready to begin the irrigation and must be removed immediately afterwards.

Perineorrhaphy

The perineum is sometimes torn during childbirth. A perineorrhaphy is an operation in which the lacerated perineum is sutured.

The *after-treatment,* like that of any other wound, is extremely important. Its care is the responsibility of the nurse. All strain on sutures, whether due to restless movements or to straining at stool, must be avoided. Sometimes it is necessary to bandage the thighs together. The sutures must be kept scrupulously clean and free from infection. Some surgeons require the patient to be catheterized for the first three to five days to avoid contamination of the wound with urine. All dressings are carried out with strict aseptic precautions, as in treating an abdominal wound. After the use of the bedpan, the part is irrigated with boric acid solution and very gently sponged until quite clean. The parts are then dried gently. Dry sterile dressings are usually applied. Aristol (an antiseptic) or zinc oxid ointment is frequently used. Any symptoms of inflammation—soreness, redness, swelling—in the wound should be noted and reported. Hot moist antiseptic dressings may be ordered in such cases. Dressings are held in place with a T binder.

When vaginal douches are ordered following a perineorrhaphy, a soft rubber catheter or an irrigating tip instead of the usual douche nozzle should be used. The douche should coincide with one of the usual dressings so as not to disturb the wound more than is absolutely necessary.

CHAPTER XXXV

THE NURSING CARE IN ACCIDENTS AND EMERGENCIES

When an accident occurs or an emergency arises, a nurse has often to proceed without a doctor. In order to do so, she must be able to recognize what has happened, think clearly, act promptly, know what to do, and how to do it.

The accidents and emergencies which most commonly occur are injuries resulting in shock, hemorrhage, a wound, bruise, burn, sprain, dislocation or fracture. These will be discussed in the present chapter.

Shock

As some degree of shock almost always follows severe injuries, one of the first points to consider in the treatment of accidents is how to prevent the development of shock, and to treat it if present.

The causes, symptoms, and treatment of shock have been discussed in a previous chapter. In shock following an accident the only other factors to consider are the conditions under which an accident occurs—a crowd usually gathers around and the patient must usually be moved to a place of safety. Quiet, rest, fresh air, and warmth are essential. Only those necessary to assist should be allowed to remain. The patient should not be allowed to remain lying on a cold floor, in the cold, or in a draft, and he should not be allowed to exert himself by walking, standing or remaining in the sitting position long, but should be placed in the recumbent position, and external warmth applied. The extremities may be rubbed to increase body heat. Whatever stimulants are at hand—tea, hot coffee, small doses of whisky or brandy—may be given by mouth, or by rectum if the patient is unconscious. Strychnin, caffein, or atropin may be given by hypodermic, if available, unless hemorrhage is also present, or in accidents resulting in injury to the head. In handling the injured part care must be taken to avoid pain, as this is always a powerful factor in producing shock.

Shock may follow even slight accidents and its probability should always be remembered. Sometimes a slight nervousness and excitement may be the only symptoms. It does not always develop immediately after the injury, but if precautions are not taken to prevent it, the patient may be completely prostrated later. Children, old people, alcoholics, anemic and debilitated people are particularly susceptible to shock. Injuries to the chest and abdomen are almost invariably followed by severe shock. In all cases the pulse must be watched closely. Alcoholic patients must be watched for restlessness and sleeplessness, as delirium tremens is very apt to develop.

HEMORRHAGE

Hemorrhage is the escape of blood from the vessels which occurs as the result of trauma, or disease.

Varieties of Hemorrhage, or classification:

1. *According to Time:*

(a) A primary hemorrhage is one which occurs at the time of the injury.

(b) An intermediate or recurrent hemorrhage is one which occurs in from 12 to 48 hours after.

(c) A secondary hemorrhage is one which occurs after a few days—from two days up to the time of complete healing.

2. *According to the Cause:*

(a) Trauma.

(1) An external hemorrhage is one in which the blood escapes from the skin or soft parts.

(2) An internal or concealed hemorrhage is one in which the blood escapes into a body cavity. Examples would be a hemorrhage into the pelvic cavity in injury to the pelvic viscera or in rupture of the Fallopian tubes; a hemorrhage into the stomach; hemothorax, and bleeding into the peritoneal cavity in typhoid fever.

(3) A subcutaneous hemorrhage is one in which the bleeding is into the soft tissues beneath the unbroken skin. Examples of subcutaneous hemorrhage are a *false aneurysm,* that is, an extensive hemorrhage from an artery into the subcutaneous tissue forming a pulsating tumor; a *hematoma,* that is, an extensive hemorrhage from a vein forming a tumor which does not pulsate; a *contusion* or bruise in which bleeding occurs from many small blood vessels; *ecchymoses* or "black and blue marks" are hemorrhages too small to form a tumor.

(b) Disease.

(1) In scurvy—bleeding from the gums.

(2) In typhoid—bleeding from ulcers in the intestines.

(3) Epistaxis—bleeding from the nose due to ulceration or congestion of the mucous membranes.

(4) Hemoptysis—bleeding from the lungs in tuberculosis.

(5) Hematemesis—bleeding from the stomach in ulcers or carcinoma, etc.

(6) Melena—bleeding from the intestines from ulceration, congestion, or new growths.

(7) Hematuria—bleeding from the urinary tract in diseases of the kidneys, ureters, bladder, prostate, or urethra, and from calculi or new growths.

(8) Cerebral hemorrhage (apoplexy)—hemorrhage in the brain from disease of the blood vessels (endarteritis).

(9) Purpura and petechiæ are very small hemorrhages (petechiæ are pin points) into the skin and mucous membranes which do not disappear on pressure. At first they are bright red, become darker and finally fade to brownish stains (due to the disintegration of the red cells and hemoglobin freeing hematin, a brownish pigment). They occur in infectious diseases—measles, scarlet fever, smallpox, typhus fever, in pyemia, septicemia, and leukemia and in purpura hemorrhagica in which there may also be epistaxis, hematuria, etc.

(10) Hemophilia is an hereditary disease which occurs almost exclusively in men, but is transmitted along the female line, that is, from mother to son. Men suffering from this disease are called bleeders. Their blood fails to clot so that bleeding from a slight wound or from the extraction of a tooth may be impossible to control and the patient may bleed to death. The treatment is administration of calcium lactate which aids the clotting of the blood.

3. *According to the Source:*

(a) Arterial hemorrhage or bleeding from an artery is most dangerous because difficult to control. It may be recognized by (1) the bright red color (oxyhemoglobin); (2) the blood escapes in spurts occurring with the heart beat or pulse; (3) in an extremity the pulse below may be obliterated and pressure above the wound (between it and the heart) controls it.

(b) Venous hemorrhage or bleeding from a vein. The blood is darker in color, due to the loss of oxygen. It flows steadily and bleeding is easily controlled. The blood pressure is very low in the veins; the walls are less elastic and muscular than the arteries so do not contract, but collapse when cut.

(c) Capillary hemorrhage in which there is a general oozing of blood from the surface. It neither spurts nor flows steadily, but wells up in the wound and the surface seems to "weep." In a deep wound the blood trickles down over the surface and gradually fills it up from the bottom.

Hemorrhage may occur from all three sources together.

4. *According to the Severity and Danger:*

Hemorrhage may be slight, severe, or profuse, according to the extent of the injury, the size and number of vessels cut, the amount of blood and rapidity with which it is lost. A severe hemorrhage occurs from a large artery or vein and is always accompanied by shock. A sudden loss is much more dangerous than a gradual loss, because in the former the heart, blood vessels and nerve centers are taken unawares and have no time to adjust themselves. A gradual loss, however, as from hemorrhoids, may cause a very severe anemia. A profuse hemorrhage occurs from large and important vessels so rapidly and in such quantities it is hard to find the source and control it. It is always accompanied by severe shock and is usually rapidly fatal.

Hemorrhages are more serious in children, in the aged, in alcoholics, and in those suffering from diseases of the kidney.

The **symptoms** of an internal hemorrhage and the systemic symptoms of a hemorrhage either external or internal have already been discussed in Chapter XXXII.

Nature's Method of Reacting to the Injury and Loss of Blood.—When a small vessel is cut, its muscular walls contract,

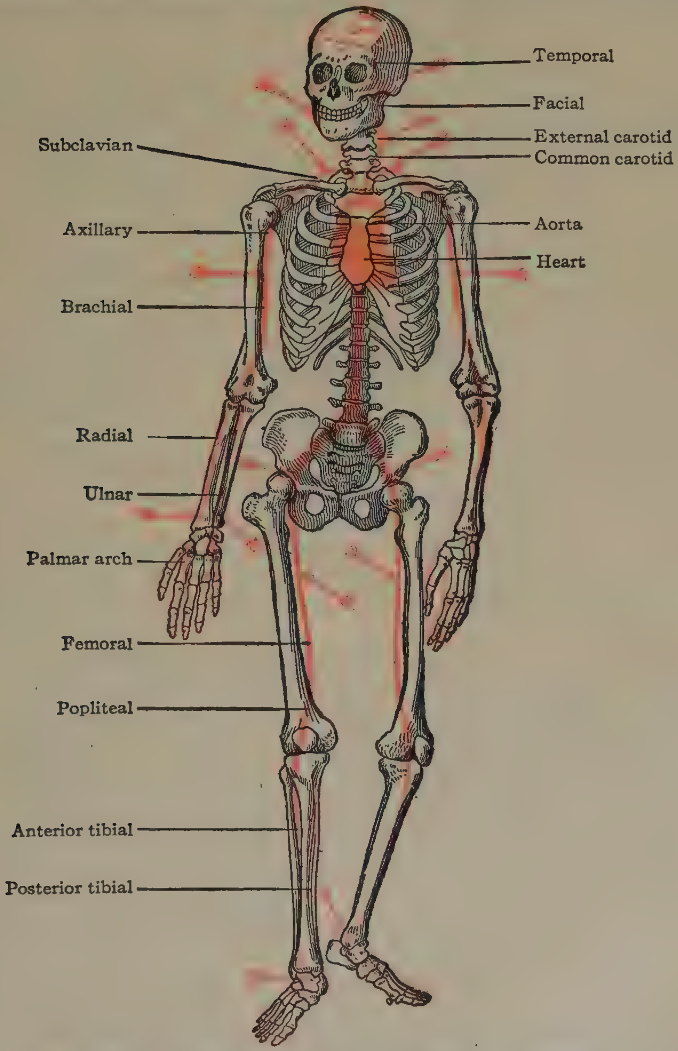

Temporal
Facial
External carotid
Common carotid
Subclavian
Aorta
Heart
Axillary
Brachial
Radial
Ulnar
Palmar arch
Femoral
Popliteal
Anterior tibial
Posterior tibial

FIG. 134.—THE RELATION OF THE PRINCIPAL ARTERIES TO THE BONES. The arrows indicate the points where pressure may best be applied. (From Morrow's "Immediate Care of the Injured," W. B. Saunders Co., Publishers.)

making its lumen smaller, and at the same time it retracts or shrinks back within its outer elastic sheath (much as a worm retracts into the ground when irritated) which then partially or completely closes over the opening. The blood, meeting this resistance, and coming in contact with air, soon begins to coagulate, forming clots around the opening and extending into the lumen, so that bleeding is checked before a serious loss occurs. If this were not so the merest scratch causing a hemorrhage would be fatal if untreated.

Clotting occurs very quickly in these small vessels, especially the veins, because their walls collapse more readily than the arteries and prevent a serious loss of blood. When large blood vessels are injured, clots cannot form at first because of the force of the blood current. As blood continues to escape, however, the volume is so depleted the brain (and other organs likewise), with its vital centers, becomes anemic. The patient faints; the vasomotor center is paralyzed; the blood-pressure is lowered; the lessened volume of blood in the vessels also weakens the heart and lowers the blood-pressure. A hemorrhage also tends to increase the coagulability of the remaining blood so that, as the force of the blood current is reduced, the blood is able to clot and finally plug up the opening before death occurs. (In wounds of the largest vessels, blood is lost so rapidly death occurs before Nature has a chance to react or recuperate.)

Later the blood-forming organs manufacture and deliver to the blood an increased number of cells to make up for those lost.

Local Treatment of Hemorrhage.—Hemorrhage may be controlled by (1) pressure; (2) position; (3) extreme heat or cold; (4) astringents or styptics; (5) ligation; (6) torsion; (7) sutures; (8) the cautery.

Pressure may be made with the *fingers* (digital pressure), a tourniquet, compresses or packing and a tight bandage. The bleeding must be controlled by whatever means lies in one's power in order to prevent the patient from bleeding to death. Pressure with the fingers along the course of the bleeding vessel will control a hemorrhage temporarily even from a large vessel. A nurse should know exactly where and how pressure may be made on large vessels such as the facial, carotid, subclavian, axillary, brachial, and femoral arteries. She should feel on herself where each artery approaches the surface and where it lies against a bone, that is, where its pulse may be most easily felt and compressed. Bleeding from the forearm can only be checked by pressure on the vessels in front of the elbow or on the brachial artery because the radial and ulnar arteries are too deeply imbedded in the tissues to be easily compressible. Their branches also anastomose freely. The same is true of bleeding from the lower leg.

In bleeding from an artery, pressure must be made above the wound, that is, between it and the heart. In bleeding from a vein digital pressure must be made below the bleeding point, that is, between it and the periphery. Also all tight constricting bands (tight clothing or elastic garters, etc.) between the bleeding point and the heart must be removed to allow the blood to return by the deep veins. This will prevent or relieve congestion (which always increases venous hemorrhage) and lessen the bleeding from the superficial veins, usually the one injured.

The Tourniquet.—Fingers soon tire so other means must be substituted. One of the most successful means of controlling bleeding from a large artery in an extremity is by applying a tourniquet above the bleeding point. The specially constructed tourniquets are made either of elastic rubber or of heavily braided material as in the army tourniquet. Improvised tourniquets may be used—rubber tubing, a folded handkerchief, a necktie, or leather strap, etc. In all cases the tourniquet must be wide enough not to cut the skin and pressure must never be made on nerve trunks. A hard firm compress is placed over the line of the artery (where digital pressure is made) and the tourniquet is tightened around it. It must be applied tightly enough to control the hemorrhage, if necessary tightly enough to obliterate the pulse. It is never left on longer than necessary because prolonged pressure causes severe pain and may cause severe injury to the tissues and nerves and may even cause gangrene. It must be left on, however, until the services of a surgeon are secured, which should be done as soon as possible. If this cannot be done within an hour usually a clot has sufficiently formed to allow the tourniquet to be loosened (but not removed) after a dressing and tight bandage have been applied to the wound.

Sterile gauze *packing* in the wound or sterile compresses held by a tight bandage will usually control hemorrhage from a vein or capillaries.

Position.—Elevation of an extremity is one of the simplest and most quickly applied remedies. Elevation alone or combined with other temporary remedies is usually successful and may save the life of a patient. Hyperflexion at the elbow or knee joints, that is, placing a pad in the bend and flexing the forearm against the upper arm or the lower leg against the thigh and maintaining the position with a tight bandage will usually control hemorrhage from an artery in the forearm or leg. This combines position and pressure. The head, or the head of the bed, is elevated in epistaxis or cerebral hemorrhage. The foot of the bed, or the buttocks, is elevated in bleeding from the pelvis, etc.

The **application of heat or cold** will often check venous or capillary hemorrhages. When hot water is used it must be very hot, 120° to 140° F., to contract the blood vessels as warm water causes further dilatation and bleeding. Heat also hastens clotting by coagulating the albumin of the blood and tissues. A hot vaginal or intra-uterine douche is one of the methods used to control bleeding from the uterus.

An ice-bag or ice compresses will often check capillary hemorrhages and will give great relief, check bleeding and prevent discoloration (black and blue marks) in subcutaneous hemorrhages such as contusions. Following a tonsillectomy, it is customary to slap the face with towels wrung out of ice water. The stimulation of the nerve endings in the skin due to the cold and slapping contracts the surface blood vessels and reflexly causes the contraction of the deeper vessels. An ice-bag is also applied to the throat. The prolonged use of ice, however, may be dangerous as it checks the circulation, lessens the supply of healing blood to the part and may cause gangrene especially in extensive bruises or in devitalized tissues. Children and old people do not stand cold well for extensive periods.

Astringents and Styptics.—Adrenalin checks bleeding by contracting the arteries. It is used both internally and externally. The vegetable and metallic astringents such as alum, tannic acid, acetic acid, silver nitrate, ferric chlorid and ferric sulphate, etc., check bleeding by precipitating the proteins, contracting the tissues and coagulating the blood. They are sometimes used to check capillary bleeding. Acetic acid is often added to a hot douche.

Ligation is exposing the bleeding vessel and tying a ligature around it.

Torsion is arresting hemorrhage by twisting the divided end of an artery which causes rupture and inversion of its inner coats.

Suturing is arresting hemorrhage by suturing wounds in large vessels too large to be closed by ligature.

The **cautery** is used to check bleeding from the cut surface of bone, of inflammatory tissue and in surgical operations such as hemorrhoids.

Systemic Treatment of Hemorrhage.—If the injury has been severe the patient will suffer from shock. If a considerable amount of blood has been lost he will suffer from this loss also and the effect and treatment will be much the same. In shock no blood is actually lost, but as it stagnates in the large veins the heart is without blood to supply the tissues so that the brain and heart muscles, etc., smother for want of oxygen and starve for want of food. In hemorrhage blood is actually lost, the effect on the brain and heart is the same and, after the hemorrhage is controlled, the treatment is much the same. Even while controlling the hemorrhage the treatment for shock should be remembered and begun at once. The patient should be kept quiet, in the recumbent position, the clothing about the chest loosened and the body warmth increased.

For the loss of blood the patient should have absolute quiet and rest in bed to lessen the work of the heart and the demands of the tissues. The head should be lowered, the trunk and extremities elevated to cause more blood to gravitate to the brain to supply the vital centers. To give the heart more blood to pump and keep blood where it is vitally needed, the limbs may be temporarily deprived of blood by elevating them and bandaging from the fingers and toes toward the heart. To increase the volume of blood direct transfusions or infusions of normal saline solution may be given. Heat may be applied to the extremities and hot fluids by mouth or by rectum may be given. Later to aid Nature repair the loss, rest, fresh air, sunlight, nutritious food and tonics (iron and arsenic) to increase the hemoglobin and stimulate the blood-forming organs are valuable.

HEMORRHAGES FROM SPECIAL REGIONS

Epistaxis or Bleeding from the Nose.—Epistaxis is a capillary hemorrhage from a deeply congested mucous membrane. It may be profuse and long continued.

The great vascularity of the nose accounts for the frequency of epistaxis. The blood supply is very free and is derived from the ophthalmic, facial and internal maxillary arteries. The mucous membrane over the turbinate bones is thick and vascular, the thickness being largely due to the abundant submucous plexus of veins. Over the inferior turbinate bone the veins form a kind of "cavernous or erectile tissue" (Woolsey) which may swell up rapidly from engorgement of the veins so as to come in contact with the septum. This tissue shrinks very rapidly on the application of astringents. The great vascularity is for the purpose of warming the air inspired in respiration.

Causes of Epistaxis:

1. Local Causes.—Traumatism, ulceration (frequent on the septum), foreign bodies, new growths, picking and scratching with the fingers.

2. Constitutional Causes.—Plethora, hemophilia, chronic anemia, preceding certain fevers especially typhoid fever, venous congestion occurring in cardiac or pulmonary diseases or cerebral congestion, puberty in delicate children, especially those with a rheumatic tendency. There may be an hereditary tendency to it.

Epistaxis may occur during sleep, the blood swallowed later being vomited, and so confused with hematemesis; or the blood may be coughed up and so confused with hemoptysis.

Treatment.—The patient's head should be kept erect, to aid the venous return. He should not bend over a basin or wear a tight collar. The clothing should be loosened. Raising the arms above the head will lessen the blood supply to the nose. The arterial blood is lessened, because most of the blood will take the easiest pathway straight up the brachial arteries rather than through the tortuous arteries of the face. The venous blood is lessened, because this position expands the chest. We instinctively assume this position when we "stretch" and take a deep breath, or yawn, after close confinement. This chest expansion lessens the pressure on the large venous trunks, with resulting aspiration of the cervical veins.

The blood also tends to clot and spontaneously check the bleeding. The patient should be warned not to blow his nose or in any way loosen the clots. Ice or ice compresses should be applied to the forehead, the bridge of the nose, and back of the neck. Ice may be pressed against the nose. Very hot or cold water may be injected into the nostrils.

Compression may be made on the facial artery by pressure on the superior maxilla near the nose on the bleeding side. Spunk may be inserted in the bleeding nostril. When moist, it swells and in this way local pressure is applied which helps to check the bleeding. The anterior nares may be packed with sterile gauze or cotton.

Astringents may be injected, or dropped into the nostrils, or cotton, moistened with astringents, may be pressed into the nostrils. Adrenalin chlorid 1:1000 solution, compound tincture of benzoin, Monsil's solution (Ferri subsulphas), peroxid of hydrogen, or hamamelis, etc., may be used. Ergot may be given internally when bleeding continues.

A hot foot-bath may check bleeding by dilating the blood vessels in the extremities and drawing blood away from the head. When considerable blood has been lost, this may cause fainting, unless given in the recumbent position.

When the above means are unsuccessful the posterior nares must be packed.

Hematemesis, Gastrorrhagia, or Bleeding from the Stomach.—The vomiting of blood is not always a sign of bleeding from the stomach because blood from the nose, throat, or lungs may be swallowed and vomited later.

The blood supply to the walls of the stomach is very free; the gastric, hepatic, and splenic arteries run along both curvatures, branches from which anastomose freely. "If the larger trunk vessels are concerned in a gastric ulcer and become adherent to the stomach wall and finally eroded, serious hemorrhage into the stomach may result." "The veins empty into the portal vein either directly or through the splenic and superior mesenteric. Hence the varicose gastric veins and the congestion of the stomach, with hemorrhage into it, in cirrhosis of the liver, or cardiac disease accompanied by portal obstruction."

When red blood cells remain in the stomach for a short time, they are disintegrated or digested by the action of the gastric juice, setting free the hemoglobin. Hemoglobin is in turn disintegrated by the acid (hydrochloric acid) medium, forming globin (a protein) and hematin (a brown pigment). The same results occur in the intestines, as either a strong acid or alkaline medium disintegrates hemoglobin. This accounts for the clotted, dark brown or "coffee ground" vomitus and also for the "tarry" stool when the hemorrhage has occurred some time before. Blood from the stomach will have an acid reaction.

Causes of Hematemesis:

1. Local.

(a) Cancer, ulcer, diseases of the blood vessels (miliary aneurysms and varicose veins), acute congestion, and following operations on the abdomen.

(b) Passive congestion, due to obstruction of the portal system as in cirrhosis of the liver, thrombus in the portal vein, an enlarged spleen, pressure on the portal vein from without by tumors.

(c) Traumatism—wounds, corrosive poisons, etc.

2. Constitutional.—Hemophilia and severe anemia.

Treatment. The patient must be put to bed in the recumbent position and kept absolutely quiet. Morphin is usually given to put the patient and the stomach absolutely at rest, and to aid in the formation of a clot. Nothing should be given by mouth except small quantities of cracked ice. Astringents such as adrenalin, or tannic acid are occasionally given by mouth. Cold compresses, an ice-bag or the ice-coil should be applied to the epigastrium. Ergotin is sometimes given hypodermically. No stimulants are given because of the danger of increasing the hemorrhage.

When the loss of blood has been great, syncope may result and must be treated. A direct transfusion may be given or an infusion of normal saline solution. The extremities may be bandaged toward the heart. The later treatment consists in tonics and a carefully regulated diet.

Hemoptysis—the Coughing or Spitting of Blood.—*Causes.*

1. Pulmonary tuberculosis, from rupture of a blood vessel.
2. Diseases of the lungs—pneumonia, cancer, abscess, gangrene, etc., and ulceration of the bronchi, trachea, or larynx.
3. Certain diseases of the heart, particularly mitral lesions which cause a damming back of blood in the left auricle, next into the pulmonary vessels, causing marked pulmonary congestion.
4. Aneurysm and erosion of a large blood vessel, which may cause a fatal hemorrhage.

The following is a table, taken from Osler, to differentiate between hemoptysis and hematemesis:

HEMATEMESIS	HEMOPTYSIS
1. Previous history points to gastric, hepatic, or splenic disease.	1. Cough or signs of some pulmonary or cardiac disease precedes, in many cases, the hemorrhage.
2. The blood is brought up by vomiting, prior to which the patient may experience a feeling of giddiness or faintness.	2. The blood is coughed up, and is usually preceded by a sensation of tickling in the throat. If vomiting occurs, it follows the coughing.

HEMATEMESIS	HEMOPTYSIS
3. The blood is usually clotted, mixed with particles of food, and has an acid reaction. It may be dark, grumous, and fluid.	3. The blood is frothy, bright red in color, alkaline in reaction. If clotted, rarely in such large coagula, and muco-pus may be mixed with it.
4. Subsequent to the attack the patient passes tarry stools, and signs of disease of the abdominal viscera may be detected.	4. The cough persists, physical signs of local disease in the chest may usually be detected and the sputa may be blood-stained for many days.

Treatment.—Complete rest in bed and absolute quiet are essential. The patient is usually very much alarmed and very much depressed. He should be reassured, his mind and body both put at rest. Death is rarely due to hemoptysis from a congested lung. (Osler.) Morphin is usually given to quiet the patient. To lessen the heart-beats and lower the blood-pressure, a hypodermic of nitroglycerin, gr. 1/100, or an inhalation of amyl nitrate (5 minims) is frequently ordered.

The patient should be turned on the affected side, if known, as the blood is then less apt to enter the unaffected lung. However, if the patient wants to sit up and can breathe better and is less anxious or alarmed when sitting up, it is better to allow him to do so. To lessen the nervous excitement and the distressing cough, chloral and bromids are frequently given by mouth or by rectum. No stimulants should be given or allowed in the food or drink. Ice may be given to suck.

An ice-bag is sometimes applied over the sternum or over the part where the bleeding is thought to be.

When the hemorrhage continues, salts are sometimes given to cause purging in order to lower the blood-pressure. When the hemorrhage is very severe the head must be lowered to keep the blood in the vital parts. The extremities may be bandaged.

When food is permitted, it should be very light.

Hemorrhage from the Uterus.—The blood supply to the walls of the uterus is very free, coming from both the uterine and ovarian arteries, branches of which anastomose freely with each other so that bleeding may be profuse.

The *causes* may be (1) inflammation of the uterus, ovaries or Fallopian tubes; (2) tumors; (3) foreign bodies; (4) displacements; (5) systemic disorders and visceral diseases such as diseases of the heart.

Menorrhagia is a profuse or prolonged menstrual flow.

Metrorrhagia is loss of blood in the intervals between menstruation. Any irregular bleeding from the uterus or unusually profuse menstrual flow, particularly after the age of thirty-five, should be reported to a surgeon without delay. It may possibly be due to carcinoma in which the only hope of cure is in an early diagnosis and surgical interference. If such a condition is brought to the attention of a nurse she should advise that person, without alarming her unnecessarily, to consult a surgeon.

A *post-partum hemorrhage* is one occurring after child-birth or a miscarriage.

Treatment.—This depends upon the cause. In all cases the patient should be put to bed and kept very quiet. The buttocks should be elevated and an ice-bag applied to the lower abdomen. Ergot may be given internally. Hot vaginal or intrauterine douches (118° to 120° F.) are usually given with or without astringents. Vaginal tampons or uterine tampons are frequently inserted to check bleeding by pressure. In giving douches or in packing the vagina or uterus everything must be sterile. An intrauterine douche or packing the uterus are procedures never attempted by a nurse except as a last resort when all other measures have failed and only when impossible to secure the services of a doctor.

The *surgical treatment* consists in the removal of the causes such as tumors, foreign bodies or displacements, etc., by operative procedure. The *systemic treatment* consists in rest and general hygienic measures and the treatment of the systemic disorder.

The treatment for a post-partum hemorrhage is discussed in textbooks on obstetrics.

Accidental Wounds

Accidental wounds may be incised, stab, punctured, lacerated, contused, or poisoned wounds.

Incised wounds are caused by a sharp, cutting instrument, such as a razor, which severs the tissues causing them to gape open.

Stab wounds are caused by a sharp, cutting pointed instrument such as a dagger or knife.

Punctured wounds are made by a sharp, narrow, pointed instrument such as a needle, splinter of wood or a nail. A rusty nail is more dangerous because being rough it injures the tissues more and also holds more dirt and bacteria. *Gunshot wounds* are also punctured wounds.

A contused wound is made by a blunt instrument. The skin is ruptured, crushed or split and the tissues around are bruised.

A lacerated wound is one in which the tissues are torn apart—the edges are roughened and jagged and there is more or less contusion around it. Examples are, the bite of an animal, torn knuckles caused by striking the mouth and teeth, a hook drawn through the tissues, and wounds caused by machinery.

Poisoned wounds may be caused by the bites of poisonous snakes or spiders, a "mad" dog, and insect bites and stings.

Dangerous Effects of Accidental Wounds:

1. Deeper structures such as tendons, muscles, nerves and large blood vessels may be injured especially in incised and stab wounds. *Peripheral nerves* may be cut or crushed or may later be surrounded by dense scar tissue during the healing process. In either case they will fail to carry messages and degeneration of the nerve will quickly follow. Symptoms of paralysis or loss of sensation should always be watched for because repair may be possible if attended to immediately but if not the resulting deformity and loss of function will be permanent. *Trophic nerves* which govern the nutrition of the tissues may be injured. The muscles will lose their tone, become flaccid and waste away from lack of nutrition. Stab wounds may also injure vital organs and hollow organs may be punctured so that their infected contents are allowed to escape.
2. Hemorrhage is apt to be severe especially in incised and stab wounds. In punctured wounds the hemorrhage may be slight because the blood vessels are pushed ahead or aside. In a lacerated wound also, the blood clots more easily in the roughened irregular tissue and torn vessels tend to contract so are not so apt to bleed.
3. Shock may be severe especially in wounds to the chest, abdomen, skull or large blood vessels.
4. Infection by pyogenic organisms or the tetanus bacillus may occur from dirt, clothing, powder, or other foreign body carried into the wound. (Slight wounds, even a pin prick, are often the most serious because so apt to be neglected.) Foreign bodies always help bacteria to gain a foothold. No matter how rigid the aseptic technique, leaving behind infected material or tissues dead, badly injured, constricted and poorly nourished so that they are incapable of surviving always results in infection. Punctured wounds are particularly dangerous because of the depth of the wound and because the tissues contract after the passage of the instrument. This closes the mouth of the wound and allows no drainage or entrance of air. The tetanus bacillus thrives in the absence of air and in the presence of pyogenic organisms which use up the air.

Infection is more apt to occur in the old or in otherwise weakened individuals.

Treatment of Wounds.—The first-aid treatment is to stop bleeding, relieve or prevent shock, keep the wound clean and absolutely at rest. If available, iodin and a sterile dressing should be applied and, if severe, a splint or sling to keep the part at rest. Expert treatment by a surgeon should be obtained as soon as possible especially in wounds about the face to avoid deformity from scar formation. Where this is impossible for hours or days, further steps must be taken to cleanse the wound. The operator should scrub his hands in the usual way for a sterile dressing. The wound should be covered with sterile gauze and the area around it should be shaved if necessary and cleansed with tincture of green soap, sterile water and an antiseptic solution. The wound itself should then be gently irrigated with an antiseptic solution such as peroxid of hydrogen 1 to 3 and gently cleansed. All foreign matter should be removed. An instrument such as a needle should be examined to see if intact. A fish-hook in a wound is very painful and difficult to remove. Pushing it on through the tissues is often the only way. In all cases extreme gentleness must be used to avoid pain, shock, bleeding or bruising. All punctured wounds should be disinfected thoroughly and kept open to let in the air. The surgeon will incise the wound opening it freely. Even slight wounds or burns caused by powder from toy pistols or fireworks and wounds contaminated with dirt, etc., from around stables are particularly liable to infection with the tetanus bacillus. A prophylactic dose of tetanus antitoxin should always be given immediately. Lacerated and contused wounds are always left open for drainage. They are apt to become infected which may result in sloughing and, in severe cases, in gangrene. Hot antiseptic dressings are frequently used.

Treatment for Poisoned Wounds.—Snake bites if poisonous cause pain, swelling and discoloration within a few minutes—blood poisoning, prostration and collapse may follow very quickly. The treatment is to prevent the poison from entering the general circulation and to treat for shock. Several tourniquets are applied at different levels, the wound is freely incised, and bleeding is encouraged—wet cupping is sometimes used for this purpose. The wound may be swabbed with pure carbolic or cauterized. It should never be sucked as a slight abrasion on the lip would allow absorption of the poison. Complete rest, external heat and stimulants are necessary to counteract the shock. The tourniquets are removed one at a time (the one nearest the body first) if no symptoms of general poisoning appear.

Poisonous bites from spiders are treated in the same way. The poison from stings of bees or wasps, etc., is acid and may, therefore, best be treated by alkaline solutions such as ammonia water, bicarbonate of soda, soap and water or a paste made of baking soda. The sting if left in should first be removed. This can be done by pressing firmly on the tissues around the wound with a round hollow object such as a key. Cold or hot compresses moistened with an alkaline solution may be applied—hot applications are frequently more soothing. Shock may be severe when stings are caused by a swarm of bees. Bromids and morphin are given to relieve pain and nervousness.

When the bites result in severe itching a weak solution of carbolic acid relieves it due to its anesthetic effect on nerve endings.

Hydrophobia or rabies is caused by the bite of a rabid animal, usually a dog. The virus causing the disease is in the dog's saliva which may transmit the disease to man through an abrasion or any open wound, not necessarily from being bitten.

The *symptoms*, in man, develop in from fourteen days to seven months after being bitten or otherwise infected. The time depends upon the amount of virus introduced, the point of inoculation and the susceptibility of the individual. When the bite is made through the clothing the saliva may be to a large extent removed. As the disease attacks the nervous system, when the bite occurs in tissues richly supplied with nerves, as in the face, the symptoms develop rapidly. The symptoms are headache, pain in the wound extending along the nerves, irritability, restlessness, sleeplessness, difficulty in breathing and swallowing due to spasmodic contractions of muscles and a marked increase in the flow of saliva. Convulsions usually follow. Death usually follows on the third or fourth day after the symptoms appear.

When the symptoms have developed the disease is invariably fatal. Prevention of the disease is therefore of the greatest importance.

Treatment.—A tourniquet is applied above the wound, if on an extremity, to prevent the poison entering the general circulation. The wound should be incised and opened freely. Bleeding is encouraged. It is then cleansed with antiseptics and hot antiseptic dressings are applied.

If the animal is known to be rabid the Pasteur treatment should be given immediately. This consists in the injection of a specially prepared, standardized dose of an emulsion of the spinal cord of rabbits which have been treated with the virus. The emulsion is given subcutaneously in a series of twenty-five inoculations. It stimulates the body to produce specific antibodies and thus renders the poison introduced in the saliva harmless. The treatment is very costly. After the symptoms have developed the treatment is unavailing.

The animal which did the biting should, if possible, be kept alive and under expert observation in order to determine whether rabid or not. Animals, in hot weather, may appear "mad" when suffering from heat-stroke. If the animal has been killed, the body should be sent to a laboratory where the brain may be examined. The presence of certain round or angular bodies found within the nerve cells or their processes is accepted as diagnostic of the disease.

CONTUSIONS

A contusion is a bruise caused by a blunt force such as a kick, blow or crushing injury. There is no wound in the skin but a subcutaneous laceration with stretching and tearing of many minute blood vessels.

Contusions are often associated with wounds and other injuries. Head injuries are always dangerous and should be treated for fracture of the skull. Injuries to the chest are usually followed by severe shock which may be profound. A blow to the pit of the stomach spoken of as a "blow to the solar plexus" may cause instant death—for this reason "hitting below the belt" is prohibited in all sports such as boxing, etc. The danger of internal injuries is also very great in blows, etc., on the abdomen and symptoms of such an injury should always be watched for. When a blow is expected the body instinctively protects itself by contracting the abdominal muscles making them rigid and board-like in order to protect the internal organs—the abdominal muscles would then be bruised or ruptured. When the blow is unexpected this protection is lacking so that intestines, kidneys, spleen or liver may be ruptured with no external evidence of injury on the surface. Rupture of the kidney, spleen or liver, which are richly supplied with blood, may result in a severe or fatal hemorrhage. Symptoms of peritonitis, internal hemorrhage, suppression of urine and blood in the urine or stools must be watched for. A fracture of a bone may also occur without external signs.

The **symptoms** of a contusion are pain, swelling, heat, discoloration and loss of function. The part is first red, then as the blood stagnates, blue-black, changing to violet, green, brown and yellow as the hemoglobin is gradually decomposed and the products finally reabsorbed. The blood works its way slowly to the skin. The discoloration may appear within a few hours or not for hours or days, depending upon the blood supply of the part and the depth of the injured vessel. Where the tissue is loose as in the eyelids a "black eye" develops almost immediately, whereas on the thighs or buttocks the thick muscles and dense fascia may prevent its appearance for days when the cause of the bruise may be entirely forgotten.

When bleeding occurs from a large vessel forming a circumscribed collection of blood enclosed by the tissue, it is called a hematoma—a blood tumor.

The **treatment** consists in the local treatment to control the bleeding and restore the vitality of the part and the treatment for shock. The *local treatment* depends somewhat upon its extent—rest, elevation where possible and applications of heat or cold are used. A splint may be used to secure rest. Cold compresses may be used in the early stages and when the bruise is not extensive. Evaporating lotions such as lead and opium are cooling and give great relief when left uncovered to allow for evaporation. Wet dressings of lead and opium are also used. They are mildly antiseptic, astringent and soothing. Wet dressings of aluminum acetate are sometimes used. Aluminum acetate is mildly astringent and antiseptic.

Magnesium sulphate solution acts as an anesthetic and relieves pain. An ice-bag as an application of cold must be used with extreme care. Its weight causes discomfort and the intense cold may cause gangrene when the tissues are badly injured and thus vitality lowered. All extensive bruises are best treated by hot antiseptic solutions. The danger of infection in the weakened tissue should be kept in mind.

After cold applications have controlled the bleeding, they are no longer desirable. The part should be bandaged with even pressure and heat applied to aid absorption and restore the vitality of the part. Massage may be used later to restore the vitality. It should never be used soon after severe bruises because of the danger of embolism.

BURNS AND SCALDS

Burns and scalds are caused by the exposure of the body to a very high temperature of either dry or moist heat. Burns are caused by dry heat—a flame, hot air, hot solids, electricity, X-Ray or radium—and by the action of corrosive poisons. Scalds are caused by moist heat—hot water and other fluids, steam or vapors. The effects produced on the tissues by burns and scalds are the same.

Burns may be *classified* into three degrees according to the depth of the injury:—(1) simple reddening of the skin; (2) dermatitis with the formation of blisters; (3) actual charring, roasting and destruction of tissues. This may involve the superficial layer only or both superficial and true skin, or the skin, subcutaneous tissues, and muscle.

The **symptoms** are both *local* and *constitutional* and vary with the extent and location of the injury. The *local* symptoms are heat, redness, smarting, tenderness, sometimes excruciating pain, swelling, and loss of function. There may be blisters or sloughing of the tissues. In *scalds* the skin is white, thrown into rugæ and the epidermis may be detached. Scalds are usually more extensive than burns because absorption by the clothing tends to diffuse the fluid over a larger area. Superficial burns are apt to be more painful than deep burns because burns involving the upper layers of skin only will leave the ends of the nerves exposed whereas when all the layers are destroyed, the nerves are destroyed with them.

The *constitutional symptoms* vary with the age and condition of the patient, the extent and location of the injury and the amount of tissue destruction. They are more marked in burns of the chest and abdomen than of the extremities and are greater in children. Children, old people and alcoholics stand burns badly. The symptoms are the symptoms of shock, of toxemia, of meningeal irritation and congestion, inflammation or congestion of internal organs—the liver, kidneys, lungs, brain or intestines —and of acute nephritis.

Shock is present in nearly all burns. It depends more upon the extent and location than the depth of the burn. An extensive, superficial burn is much more serious than a deep burn of limited area. A burn involving an area equal to one-third of the body surface is usually fatal. Shock is more apt to be fatal in burns of the chest or abdomen and in children, old people and alcoholics.

Toxemia is due to the absorption of toxic products from the dead tissues. Later during the period of suppuration the toxemia will be caused by septic absorption. The *symptoms* are a high temperature, extreme thirst, weak, rapid pulse, low blood-pressure, vomiting and diarrhea. There may be delirium or stupor and finally convulsions or coma and death.

The *symptoms of meningeal irritation and congestion* are headache, restlessness, delirium and coma.

Inflammation and *congestion of internal organs* may be very severe and are frequently fatal. They may result from interference with the functions of the skin, the absorption of toxic products, the increased work thrown upon the liver (which acts as a detoxifying agent changing toxic products into non-irritating substances) and upon the kidneys and other organs of elimination. It may be the reflex effect of the extreme heat on the nerves in the skin, which causes a contraction of the blood vessels in the skin with resulting congestion of internal organs, together with the paralysis of the vasomotor center resulting from the shock. This may play a large part in bringing about the internal congestion.

Edema of the glottis, acute *bronchitis,* and *pneumonia* are to be looked for particularly when hot vapors or steam, etc., cause irritation of the mucous lining of the throat.

Acute nephritis nearly always follows severe burns due to the congestion, the increased work due to failure of the skin and the increased and highly toxic waste products. The urine may be scanty and general symptoms of suppression will appear.

Inflammation of the intestines is more apt to occur following burns of the abdomen. Occasionally a duodenal ulcer develops which may result in hemorrhage or perforation with peritonitis. A dark tarry stool suggests intestinal hemorrhage; persistent vomiting, abdominal pain and distention suggest peritonitis.

Treatment for Burns.—As death is most frequently due to shock, the relief of shock should be the first consideration. (See treatment of shock.)

Local Treatment.—This depends upon the extent and depth. When limited in extent and severity the treatment is rest and the application of cold wet dressings of normal salt solution or a saturated solution of bicarbonate of soda. Picric acid is frequently used. It is both antiseptic and astringent and promotes healing. It is not used on extensive burns because of the danger of absorption and poisoning, the symptoms of which are a yellow skin, fever, diarrhea and dark urine. When using picric acid care must be taken to protect the bed linen, etc., as it stains it yellow. Carron oil, which consists of linseed oil and lime-water, gives relief but as it is difficult to keep the wound surgically "clean" it is considered a "dirty" dressing. Soothing ointments, such as zinc oxid, boric, cold cream or vaseline are sometimes used. The ointments used should be sterile.

In burns of the second degree, the blisters are opened with sterile scissors at the lowest border and the fluid is allowed to escape in order to prevent infection. A wet dressing is then applied.

Burns of the third degree in which the deep skin and with it nerve endings are exposed must be protected from the air (which increases the pain) and dressed as infrequently as possible to prevent infection and allow healing to take place undisturbed. Antiseptic dressings are applied. Bandages must be put on lightly to allow for swelling. Codein and morphin are given to relieve pain.

Clothing must be removed with the greatest care—always cut the clothing to remove. Soak the part thoroughly with peroxid of hydrogen before attempting to remove the clothing. See that the wound is quite clean and free from charred pieces of clothing. Remove the clothing very gradually dressing each part as exposed—never at any time in applying the dressings expose a large area.

Burns of the third degree are frequently treated with ambrine or a substitute consisting of a preparation of paraffin wax, white wax and resin cerate which melt at a low temperature. The ambrine or its substitute is melted over a water bath, is then poured into an atomizer from which it is applied to the burned area. The wound is first thoroughly cleansed with boric acid or salt solution. A thin layer of cotton is then applied and sealed with more wax. This excludes air, prevents infection and supplies an aseptic dressing beneath which healing can take place. When heating the wax never bring to the boiling point as it will cause it to crumble when applied. A similar clean, protective dressing is sometimes provided by painting the area with chromic acid, "tanning" the skin. Ointments containing phenol are frequently used. Phenol acts as a local anesthetic, is antiseptic and prevents any disagreeable odor from the sloughing tissue. These ointments, therefore, give comfort to the patient mentally and physically and prevent him from being a source of discomfort to others in the ward.

Extensive burns may be treated with continuous wet dressings, by immersion or by the "open treatment." In treating burns of the hands and fingers place gauze between the fingers to keep them apart otherwise they will become webbed in healing. Treatment by immersion may be used for an extremity or for the entire body. Mild antiseptic solutions are usually used such as boric acid or water containing bicarbonate of soda. The temperature should be neutral, that is, 92° to 97° F. This excludes the air and surrounds the part or the body with a neutral medium which is soothing to the nerve endings and thus relieves shock, pain and restlessness. It keeps the surface clean and prevents the absorption of toxic products. The temperature must be kept even throughout and the solution must be changed at least once during the day during which process sterile dressings are applied or the body may be wrapped in a sterile sheet. The bath must be arranged so as to cause no discomfort, strain or exertion on the part of the patient. Suppurating areas may be treated by immersion in an antiseptic solution. Warm antiseptic dressings may be used. They must be changed frequently and the area irrigated and treated like any discharging wound.

The "open treatment" consists in surrounding the part with air kept at an even temperature of 100° F. This causes a thick, dry crust to form quickly over the area under which healing, by the formation of granulations, takes place. This is called healing under a crust. This crust forms a protective covering preventing infection, excluding air and relieving discomfort. If the resistance of the tissues is lowered infection with suppuration may occur under the crust with absorption of septic products and general toxemia. Watch for an elevated temperature, a rapid pulse and the symptoms of toxemia. The treatment is to remove the crust with a warm bath 96° F. containing bicarbonate of soda which softens the crust. The crust is allowed to form again or moist antiseptic dressings may be used. When this method of treating wounds is used, care must be taken to exclude flies. They may lay their eggs in the wound, which rapidly hatch into larvæ or maggots.

Burns Caused by Corrosive Poisons.—The chemical substances may be acids or alkalies. Burns caused by acids should be irrigated freely with alkaline solutions to neutralize the acid. Limewater, weak ammonia or a solution of bicarbonate of soda may be used. Carbolic acid or creosote should be neutralized by alcohol or whisky after which a dressing of alcohol or a soothing ointment may be applied—oil should not be used as it hastens the absorption of carbolic acid. Burns caused by alkalies (caustic soda, caustic potash or ammonia, etc.) should be treated with boric acid, vinegar and water or lemon-juice and water.

The *systemic treatment* of burns consists in the relief of shock, toxemia, congestion of internal organs, and nephritis.

Shock is relieved by rest, quiet, external warmth, stimulants, the relief of pain and immediate attention to the burned area. Pain is a powerful factor in producing shock and must receive immediate relief—morphin is usually necessary. Pain must be avoided in removing clothing and in all subsequent dressings.

Toxemia is relieved by the proper care of the wound—keeping it clean, free from infection, removing sloughing tissue or septic discharges and preventing their absorption; and by diluting the toxic products and flushing them out of the system—by forced fluids by mouth, rectum or hypodermoclysis, by keeping the bowels open with cathartics and increasing the elimination by the kidneys.

Meningeal irritation with headache, delirium and restlessness, etc., is relieved by an ice-cap applied to the head and the administration of sedatives, usually bromids.

Congestion of internal organs may be prevented by the application of cold compresses or the ice-coil. Turning the patient frequently, and steam inhalations to soothe the irritated mucous membrane of the respiratory tract will help to prevent *pneumonia.* Liquid diet and keeping the intestines free from irritating matter will help to prevent intestinal inflammation.

Acute nephritis may be prevented or relieved by lessening the work of the kidneys and aiding them in eliminating the waste and poisonous products. Their work is lessened by limiting the diet to milk and other fluids and by increasing the elimination by the intestines, also by preventing the absorption of toxic and septic products. Eliminations are aided by forced fluids, lemonade, imperial drink and other diuretics.

Local Complications of Burns.—The burned area may become infected with pyogenic organisms commonly found in the skin. This may result in *suppuration* and *general toxemia* from the absorption of septic products or septicemia from the invasion of the blood stream by bacteria. Infection by the streptococcus pyogenes or erysipelatis causing *erysipelas* may occur, particularly in burns about the face. Extensive sloughing of the tissues may lead to a *secondary hemorrhage. Embolism* may occur from the entrance of tissue cells into the blood stream. *Contraction of the tissues* in healing may occur with an unsightly scar and if near a joint, stiffness and limited motion.

FROST-BITES

Frost-bites occur as the result of prolonged exposure to extreme cold. The parts of the body most commonly affected are the fingers, toes, ears, nose, and the skin over the cheek bones. These are the most exposed parts, the blood vessels are near the surface so quickly affected by the cold, and the blood is soon chilled. The circulation in the extremities is also apt to be poor while the ears, nose and cheek are not protected by clothing or hair.

The injury is said to be due to the direct effect of the cold on the fluids in the tissue cells. It is a well-known fact that water expands in freezing. The injury is described by Dr. W. G. MacCallum as follows:—"The noxious effect of the freezing is explained either as due to mechanical tearing of the cell as the ice crystals are formed, or to the concentration of salt around the crystals, or to the withdrawal of water from the cells to form the ice." The result is a serious inflammatory reaction or gangrene. It is further explained "that the gangrene of the extremities which follows such chilling is by no means always directly due to the cold. On the contrary, it is the result of protracted ischemia from extreme contraction of the blood vessels or their obstruction by thrombi." The parts are at first livid; later, as venous congestion occurs, cyanotic, swollen and pulseless, then turn purple and finally a greenish-black.

Chilblains may occur in the fingers and toes as the result of exposure to less extreme cold, with moisture. The parts are at first pale due to contraction of the blood vessels and the resulting anemia. Later they become cyanotic and, when in the warmth, remain purplish but swell and become extremely painful and disabled.

The **treatment** in the early stage of frost-bite consists of rubbing the part with snow or a cloth wrung out of ice-cold water, gradually making the application warmer. The patient should not be brought into a warm room until the color of the part is normal, showing that the circulation has been reëstablished. The aim is to restore the tone of the blood vessels and allow the blood to return gradually. The application of heat to a frozen part in which the vessels are paralyzed and engorged with venous blood would further reduce their tone and increase the supply of blood so rapidly as to cause rupture and bleeding into the tissues and almost certain death of the part.

When the circulation is reëstablished, a loose dressing is applied, with warmth and elevation of the part to improve the circulation. If sloughing occurs, hot antiseptic dressings are usually applied to hasten the separation of sloughs and to lessen the danger from the absorption of septic material. If gangrene develops it is usually of the dry type. The part is kept dry, may be dusted with a dry antiseptic powder, and covered with an absorbent cotton dressing until separation takes place at the line of demarcation or, in some cases, it is removed by amputation.

CHAPTER XXXVI

NURSING CARE IN ACCIDENTS AND EMERGENCIES (Continued)

INJURIES TO BONES AND JOINTS

Injuries to bones and joints such as sprains, dislocations, and fractures are among the common accidents which occur in which a nurse should be able to give immediate relief before the arrival of the surgeon, and which often demand skilled nursing care in the after-treatment. The treatment and nursing care of such accidents will be discussed in the present chapter.

SPRAINS

A sprain is an injury to a joint caused by a sudden, violent movement—a wrench, a twist or a strain which, if continued, would result in a fracture or dislocation.

The result is bruising of the synovial membrane, which causes very severe and sometimes sickening pain because of its abundant nerve supply; a rupture or severe stretching of the ligaments, tendons and muscles which support the joint; and a rupture of blood vessels with bleeding into the tissues and often into the synovial sac.

This injury to the tissues is followed by an inflammatory reaction which gives rise to an inflammatory exudate in the ligaments, tendons, muscles, subcutaneous tissue, and sometimes into the synovial sac.

Sprains of the wrist and ankle are the most common because these joints are more exposed to injury, but sprains of the elbow and knee and other superficial joints also occur.

Symptoms.—There is first very severe pain, sometimes so severe as to cause fainting or nausea and vomiting. The joint swells quickly, is extremely tender to the touch, and soon becomes discolored if the surface blood vessels have been injured. Discoloration from rupture of the deeper vessels may not appear for a day or two. When the inflammatory reaction begins there is heat and increased swelling, tenderness and pain on motion.

Treatment.—A sprain is often very wrongly considered a slight injury—"just a sprain"—when in reality it may be a very serious injury. A fracture may be very easily and is frequently mistaken for a sprain. Even a surgeon is sometimes unable to determine the diagnosis without the aid of the X-Ray and sometimes a general anesthetic. An X-Ray is essential. Even a sprain, if neglected or carelessly treated, may result in a permanently weak joint or in a partial or complete stiffness with continued pain. It is dangerous to attempt to "walk off" a sprain of the ankle unless it is very slight or has been properly treated and supported by the correct application of strapping, preferably with zinc oxid adhesive plaster.

The treatment depends upon the severity of the case and also varies with different surgeons. Efforts are first made to relieve the pain, to arrest the hemorrhage and serous effusion and to aid its absorption. Sometimes cold applications in the form of ice compresses, aluminum acetate, or aluminum and opium solution are used with the part elevated and kept at rest. Sometimes the part is immersed in hot water, the temperature being gradually increased until it is as hot as the patient can stand. This relieves the pain, contracts the blood vessels and lessens the hemorrhage and effusion. The part is then tightly bandaged to prevent further congestion. Sometimes the part is strapped firmly enough to give support and relieve the strain without preventing movement and the patient is encouraged to use the part freely. This helps to maintain a free circulation and to prevent stiffness. For severe sprains well-padded splints or molded plaster-of-Paris casts may be used, though seldom necessary. For a sprained wrist the arm may be supported and elevated by a sling. To increase the circulation about and in the joint local applications of heat (baking, electric light, high frequency current, hot water), massage, and passive movements are used.

DISLOCATIONS

A dislocation is the separation of the articular surfaces of two or more bones entering into the formation of a joint.

Symptoms.—There is first sickening or nauseating pain, greatly increased by motion of the part which causes pressure of the dislocated bone on nerves, etc. Deformity with a lengthening or shortening of a limb occurs depending upon the line of displacement. There is limited motion or loss of function in the part. After the reduction there is no tendency to a redisplacement as in a fracture. There may be swelling of the surrounding tissues. Some degree of shock is nearly always present.

Complications Which May Occur.—Injury to blood vessels, nerves and soft tissues, or contusions may occur. One or more bones may be fractured. The dislocation may be compound, that is, an external wound leads to the injured joint. A severe hemorrhage resulting in a hematoma sometimes occurs.

Treatment.—*First Aid.*—The limb should be put at rest in the position most comfortable for the patient. For a dislocation of the joints of the upper extremity—shoulder, elbow, or wrist—apply a splint or a bandage and support the arm in a sling. For a dislocation of the hip, knee, or ankle, the patient should be put to bed and a splint applied as in a fracture of the femur. To lessen the pain and swelling, ice compresses or lead and opium solution may be applied. Treat for shock if present.

The reduction of a dislocation requires both considerable knowledge and skill, and should never be attempted by an inexperienced person if it is at all possible to obtain the services of a surgeon, even after the lapse of many hours. Treatment as early as possible, however, is essential. Permanent injury may be done by improper manipulation. Frequently a general anesthetic is necessary to relax the muscles and relieve pain before reduction is possible.

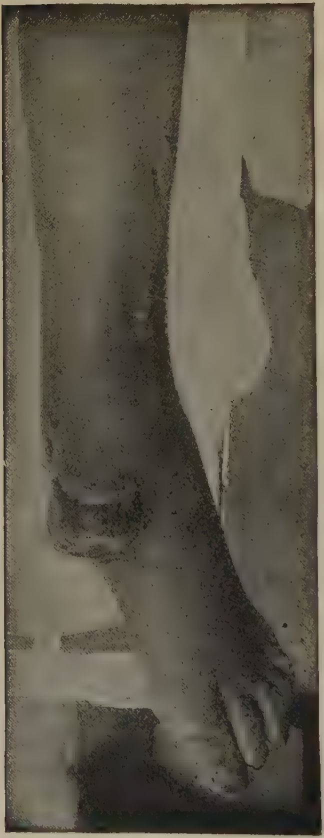


FIG. 135.—COMPOUND FRACTURE (DaCosta). (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

Surgical Treatment— (*Brewer*). —The dislocation is reduced by manipulation and extension or by open operation. Reduction should be accomplished as soon as possible because the injury is followed by a marked inflammatory reaction with considerable exudation which (if reduction is not secured) later forms dense fibrous material which fills up the socket or forms adhesions binding the bone in its abnormal position. The attached muscles also become contracted limiting the function of the part. Restoration of function in the joint and muscles is secured by gentle passive motion. Later massage, baths, and electricity are used.

Compound dislocations exposing the larger joints are extremely serious, and demand an extensive operation. The shock and injury to the surrounding tissues, blood vessels and nerves are usually very severe. The danger from infection and general sepsis is great and amputation is often necessary.

FRACTURES

A fracture is an injury which produces a solution of the continuity of a bone, that is, a break or violent separation of a bone into two or more fragments.

Varieties of Fractures:

1. A *simple fracture* is one in which the bone is broken but the skin and surrounding tissues are unbroken.
2. A *compound fracture* is one in which a wound in the skin

and surrounding tissues exposes or leads to the ends or fragments of the broken bone.

3. A *comminuted fracture* is one in which the bone is crushed, splintered, or broken into a number of small fragments, the lines of the break communicating with each other. The general direction of the break is indicated by the terms transverse, longitudinal, oblique, spiral, T or V-shaped.

4. An *impacted fracture* is one in which one fragment of bone is forcibly driven into another and remains more or less fixed in that position.

5. A *greenstick fracture* is one in which the shaft is bent and cracked but not completely broken through. This frequently happens in children because their bones are not yet fully hardened or calcified, but are still young and elastic like a green twig. Other incomplete fractures are depressions where a portion of a flat bone is driven inward, but not severed—depressions of the skull are frequent; and *separations at the epiphyseal line* in early life before complete union has taken place.

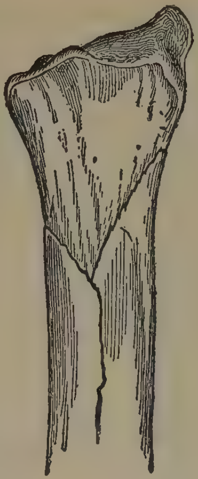


FIG. 136.—A COMMINUTED FRACTURE (DaCosta). (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

6. The terms *single, double,* and *multiple* refer to the number of breaks occurring in a bone; the terms *recent, old, united* or *ununited* refer to the time of the injury and the degree of repair which has taken place.

Fractures Are Also Classified Into:

1. Fractures of the diaphyses (shafts) in which motion is felt at a point where there should be none, the broken ends of the bone tend to overlap (due to the weight of the limb and the pull of muscles), causing more or less shortening of the limb.

2. Fractures of the epiphyses (extremities) in which the articulations are frequently involved.

A *Colles'* fracture is a fracture of the lower end of the radius and of the styloid process of the ulna. It is frequently called the "silver fork" fracture because the characteristic deformity gives the limb the appearance of a fork.

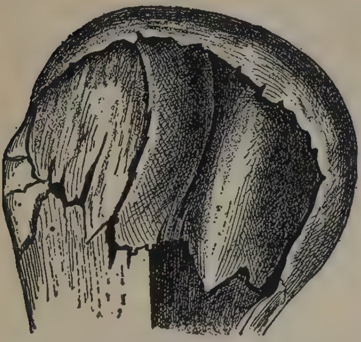


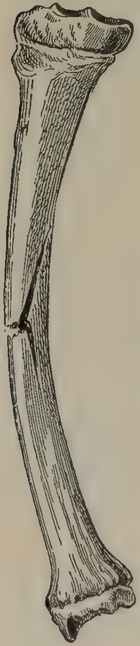
FIG. 137.—IMPACTED FRACTURE OF THE TUBEROSITIES OF THE HUMERUS. (From Morrow's "Immediate Care of the Injured," W. B. Saunders Co., Publishers.)

A *Pott's* fracture is a fracture

of the lower end of the fibula and of the internal malleolus (tibia).

How to Recognize a Fracture:

1. By the *subjective* symptoms—*pain* and *loss of function.* Following an accident, if the injured person complains of pain and inability to use the injured part, or severe pain on attempting to use it one should suspect a fracture and treat accordingly. For instance, if in an accident, a man has fallen and is unable to get up or is unable to walk or if he is unable to use an injured arm or hand, the bones of the leg or arm are probably fractured. He may even be able to walk and still have a fracture of the fibula because this bone gives little support and the tibia will act as a splint for it. Again the ability or inability to use the fingers is not a safe test, as is popularly supposed, of a suspected fracture of the bones of the forearm. They may still be used, though with great pain, even though these bones are broken.



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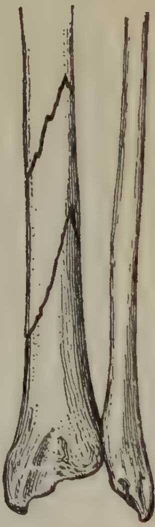


Fig. 138.—Green-stick Fracture (DaCosta). (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

Fig. 138*a*.—A Multiple Fracture.

Following an injury to the pelvic region the inability to stand or sit, a feeling of "coming apart," or bleeding from the rectum or bladder point to a fractured pelvis. Severe pain on breathing or coughing, or bloody expectoration following a chest injury suggests a fracture of one or more ribs. In fractures of the skull the symptoms may be absent or very slight. There may be merely headache and mental confusion or there may be unconsciousness and paralysis with a slow pulse and breathing.

2. By the *objective* symptoms.—There will be localized *tenderness* and *abnormal mobility,* that is, movement where there should be none, as for instance between the shoulder and elbow. *Deformity* usually occurs due to the displacement of the broken ends, to hemorrhage from the deep muscles or periosteum, and swelling of the soft parts. The displacement is due to the pull of muscles attached to the fragments. The limb may be in an *unnatural position* (due to the pull of muscles and weight of the limb) with a characteristic deformity. Overlapping of the broken

ends may cause one limb to be shorter than another. *Crepitus* may be present due to the displacement of fragments and the grating caused by the rubbing together of the ragged edges. This may be felt by the examiner and sometimes heard but should not be searched for because the slightest movement of the ragged bone fragments adds further injury to the surrounding tissues. *Swelling* and *discoloration,* due to injury of the surrounding tissues, may be present.

In a fracture of the base of the skull there may be bleeding from the ear from rupture of the tympanic membrane. The blood may also pass along the Eustachian tube and escape through the nose or mouth or it may be swallowed and vomited later. The blood may also escape into the orbit turning the white of the eye red (ecchymosis). Cerebrospinal fluid may also escape due to rupture of the dura and arachnoid membranes. Cranial nerves (which pass out from the base of the brain) may be injured, especially the facial and auditory nerves, resulting in facial paralysis and deafness.

Sometimes the use of the X-Ray is the only means of making an accurate diagnosis. In fractures of the spine or skull the diagnosis is made chiefly by the observation of symptoms of injury to the brain or spinal cord, by the use of the X-Ray, or by an exploratory operation.

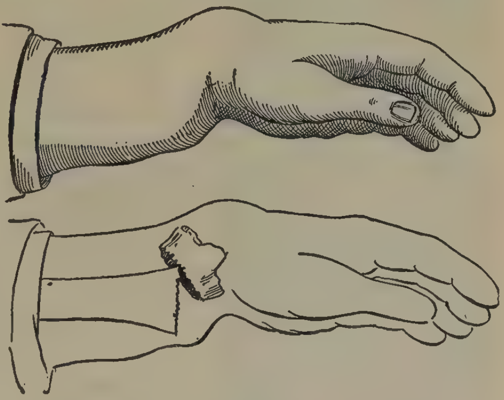


FIG. 139.—COLLES' FRACTURE SHOWING THE CHARACTERISTIC DEFORMITY. (From Owen's "Treatment of Emergencies," W. B. Saunders Co., Publishers.)

Systemic Symptoms.—In all injuries due to violence the patient will suffer from shock which will be more or less severe and prolonged. Fractures of the skull, spine, pelvis and femur are especially apt to be accompanied by shock. Frequently there will be gastric disturbances, general malaise, and a slight rise in temperature.

Complications Which May Occur or Develop.—Injury and bruising of the surrounding tissues—the skin, muscles, fascia and joints, etc.—may occur. *Nerves* may be torn, bruised or stretched. Internal organs such as the lungs, pleura, or bladder may be perforated or the brain or spinal cord may be injured. *Blood vessels* may be injured. Nerves and blood vessels are especially apt to be injured when they lie in close contact with the bone as in fractures of the humerus and femur. For this reason the pulse at the wrist in a fractured arm and at the dorsum of the foot in a fractured leg should always be carefully examined. Injury to the arteries may give rise to traumatic aneurysms and injury to the main arterial trunk of a limb, upon which its nourishment and life depend, may cause an advancing gangrene requiring amputation. Injury to blood vessels may result in hematoma which by pressure may cause edema and gangrene.

Infection may occur and should be guarded against in all compound fractures, and in fractures of the skull, nose, or jaw, which are frequently compound. The nose and mouth are never free from germs. In fractures of the base of the skull, the nose and ears must be kept clean and infection prevented from entering by placing sterile cotton in the nostrils and ears. Infection may cause meningitis or septicemia, either of which may prove fatal.

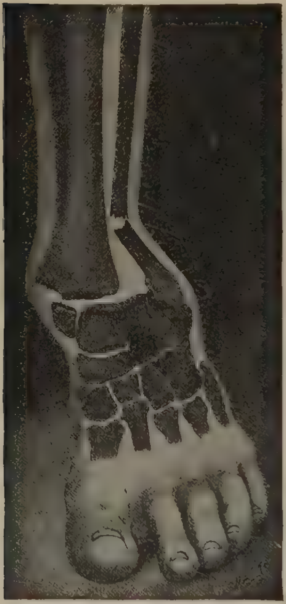


FIG. 140.—POTT'S FRACTURE (Fowler). (From Morrow's "Immediate Care of the Injured," W. B. Saunders Co., Publishers.)

Ischemic (*anemic*) *paralysis* sometimes occurs. This is a form of paralysis and deformity due to pressure which temporarily shuts off the supply of arterial blood from the part and often results in the permanent loss of function of an extremity. The most frequent *causes* are the application of circular casts of plaster-of-Paris, tight bandaging, or too tightly applied splints to a fresh fracture, which does not allow for the increased blood supply which always occurs in an injured part with exudation and swelling of the tissues. The increasing pressure on the soft parts causes an acute ischemia of the parts, which if unrelieved for six or more hours produces such marked degenerative changes in the muscles and nerves that paralysis and a permanent contraction of muscles follow with sensory and nutritional disturbances and in some cases gangrene. This usually occurs in an extremity, most frequently in the forearm. Most of the venous blood from the hand and arm returns by superficial veins which are readily affected by pressure.

The *symptoms* of this very serious condition which must be closely watched for are pain, coldness, numbness, edema and cyanosis of the extremity. In order that these symptoms may be recognized immediately, the fingers and toes are always left exposed, and if any of the above symptoms appear, they should be reported immediately so that the bandage, splint or cast may be removed or loosened.

Fat-embolism.—Sometimes fat globules from the bone marrow of the broken bone enter the blood stream and are carried along until first arrested in the pulmonary capillaries where they form a plug shutting off the circulation. Sometimes they are carried along until they become lodged in the capillaries of the brain or other viscera. This condition may prove rapidly fatal. The *symptoms* which warn us of this very grave condition are cyanosis, rapid, labored breathing with extreme shock and sometimes restlessness, delirium, and coma.

Restlessness, insomnia, and *delirium tremens* may be present in alcoholics. This is said to be because the accident frequently occurs during or after a state of intoxication. Alcohol is a powerful depressant so that the shock from the injury is apt to be more severe in an alcoholic patient.

Late Complications Which May Develop.—Motion in the joint may be limited. Paralysis may result from injury to a nerve trunk or from the pressure of callus. Poor circulation may cause atrophy of muscles with resulting weakness and lack of use. Delayed union, non-union or vicious union (union with deformity and loss of function) may take place. In the forearm, faulty reduction or excess callus may limit the space between the radius and ulna and so limit its normal rotation in pronation and supination resulting in a stiffened elbow and loss of function of the arm and hand.

Repair of a Fractured Bone.—The repair of a fractured bone depends upon the extent of the injury to the bone, the periosteum, the nutrient blood vessels, the nerves, the surrounding tissues, the presence or absence of infection, the condition of the patient, and the treatment given.

When, by proper treatment, the fragments of a broken bone are accurately replaced and kept at rest in their normal relations, repair takes place very rapidly (in from three to six weeks), in the absence of infection, if the part is well supplied with healing blood and the injury to the periosteum is not too great.

In fractures the broken ends of the bone are quickly surrounded by a hemorrhage, from the bone marrow and surrounding tissues, which is soon checked by clotting. The injury to the soft tissues—muscles and fascia—calls forth a slight inflammatory reaction with a resulting hyperemia and exudation of fluid and leucocytes into the tissues with swelling around the broken fragments. Fresh supplies and more workmen are thus rushed to the spot to repair the damage and carry away the débris.

The osteoblasts (active bone-forming cells) from the endosteum and inner vascular layer of the periosteum are the master-builders who immediately begin to repair or rebuild the new bone following Nature's (the architect) plan, that is, "by methods identical with those concerned in its first formation" (MacCallum). The periosteum is essential because bone is probably not formed by the bone corpuscles which are buried in the rigid bone (MacCallum). A cement-like substance called callus is produced and poured around and between the broken fragments cementing them together and forming, so to speak, the framework of the new building. This callus is at first a homogeneous ground substance (like cartilage) inclosing the newly-formed bone cells. New blood vessels from the periosteum gradually extend into it, giving it new life; tough fibers are erected or extended until they permeate the whole mass, converting it quickly into a firm hard tissue which may be felt around the broken bone by the end of the first week. The blood deposits lime salts in the callus so that in from three to six weeks it is converted into new bone. Although for a time the building may be clumsy and imperfect in design, it serves a useful purpose and, by degrees, alterations are made until it becomes wonderfully like the original plan designed by Nature.

In the meantime the blood and lymph and the assistant workmen (leucocytes) are busy picking up and carrying away the external and internal scaffolding or buttresses (the excess callus around the bone and in the medullary canal) which are no longer needed for support, until finally the ground is quite clear, the building is ready for use, and the function is normal.

Now if the bones have not been properly replaced (the responsibility of the surgeon) or if replaced and then disturbed by more or less movement (*the responsibility of the nurse*), Nature will do her best to bridge the gap, but the repair will be slower, the building will be sprawling, so to speak, and take up ground belonging to the muscles and so greatly interfere with their function. The result may be a permanent deformity and loss of function. This would be a very serious handicap for which no nurse would want to be responsible.

In an extensive comminuted fracture, new bone forms around and between all the fragments and, if not properly treated, may extend into the muscles and may also surround and include nerves with consequent impairment or loss of function in the part.

The repair of bone and of the surrounding tissues depends to a large extent on the *free circulation* of healing blood in the part. Injury or treatment which interferes with the blood supply may cause death of bone tissue and result in non-union or a greatly prolonged process.

The repair of a compound fracture is the same as that of a simple fracture, and the repair of the soft parts the same as that outlined on page 343, either by primary union or by the formation of granulations.

Infection greatly delays the union of a broken bone. It also causes death of portions of the bone and the formation of sinuses leading to the dead fragments or sequestra, which do not close but continue to discharge until all the dead bone has been removed. The resulting abscesses may spread to the muscles and fascia, the tissue destroyed be replaced by scar tissue which will greatly interfere with the function of the part. It is said that a mild infection stimulates bone formation so that an excessive irregular growth of callus results, encroaching on the muscles and joints and interfering with their function.

Delayed Union or Non-Union.—Sometimes for various reasons the bones fail to unite. This may be due to infection, to the presence of dead bone, to faulty position, to constant slight movement, to removal of too much bone, the healing over of the broken ends and plugging of the medullary cavity with callus; to poor circulation in the part, lack of an inflammatory reaction or to the general condition of the patient with feeble powers of repair.

General Factors to be Considered in the Treatment of Fractures.—The treatment in general may be considered under three main headings:

1. First-aid treatment.
2. Reduction and immobilization.
3. After-treatment. The responsibility of the nurse.

First-aid Treatment.—This is extremely important for it determines the whole aftercourse—the duration, the restoration of function, the loss of a limb, and even the life of the patient depend upon it.

The important things to remember in the first-aid treatment are as follows: The main object is to prevent further injury. If a doctor can be quickly summoned, and the injured person has fallen but is in a place of safety, it is wisest for an inexperienced person to merely make the patient comfortable with pillows, etc., where he lies, disturbing the part as little as possible. One should always remember the danger of shock and keep the patient in the recumbent position with the head low (except in suspected fracture of the skull), and as quiet as possible. If there is a wound, bleeding, if present, must be checked and every precaution must be taken to prevent infection. The clothing should be removed, cut away if necessary and removed from the uninjured side first. The wound and surrounding skin should be painted with 2 per cent. iodin, covered with a sterile pad and bandaged. Later more thorough treatment is given under strictly aseptic conditions.

The part should, if possible, be put completely at rest or immobilized. It should be placed in a position which tends to cause relaxation of the muscles, the contractions of which are causing pain and displacement. A patient will often instinctively do this for himself. For instance, in a fractured clavicle he inclines his head to the injured side, raises his shoulder and supports his elbow; in a fracture of the upper extremity, he will support his elbow, forearm, wrist or hand; in a fracture of the ribs, he will take shallow breaths, lean toward the injured side and press his hand against it. Rest and immobilization are necessary in order to relieve pain, prevent further displacement of fragments and further tearing (by ragged edges of bone) of the soft tissues, blood vessels or nerves. An extremity must never be allowed to dangle and even after splints, etc., are applied the patient must not be allowed to attempt to use the foot. For instance, he must not stand or attempt to walk when a fracture of the lower extremity is suspected.

In handling the fractured part the utmost care and gentleness must be used. All cases should be handled as little as possible. In lifting a limb it should always be carefully supported under the broken ends and under the joints above and below the break. Movement at either joint must further displace the fragments. It is best to apply an even support to the whole limb before lifting. Careless handling may make a simple into a compound fracture, a very grave accident with danger of infection, loss of a limb or even of life. It may cause nerves to be torn or bruised and blood vessels to be injured, which may result in a severe hemorrhage, or gangrene, and necessitate amputation. One should watch for discoloration and note whether the pulse in an extremity is present and normal or not. One should also watch for symptoms of internal injury to the brain, spinal cord, lungs, bladder or rectum.

Swelling of the part adds to the pain and greatly hampers the proper reduction of the fracture. Pain is always to be avoided as far as possible. It is one of the common factors in the development of shock. Swelling and pain may be prevented by applying ice to the part, proper support and elevating where possible.

All patients suffering from shock or painful contusions, from fractures of the skull, pelvis or lower extremity should be carried on a stretcher, with as little jolting as possible, to their home or to a hospital.

First-aid Methods of Securing Immobilization.—The part may be immobilized by the application of (1) bandages; (2) adhesive strapping; (3) splints.

Bandaging is used chiefly in the following cases: A four-tailed bandage or a Barton bandage may be used for a fractured jaw; a Velpeau bandage for a fractured clavicle. In the absence of splints a fractured arm may be bandaged to the side (the axilla and side being first well-padded) and a fractured leg to the other leg, in this way using the patient's own body as a splint. A bandage or tight binder is sometimes used for fractured ribs but must not be left on too long as they restrict the action of both lungs. A triangular bandage in the form of a sling is used to support the forearm in fractures of the clavicle, arm or hand. A tight binder may be applied around the hips and the knees bandaged together to give support and immobilize the hips in a fractured pelvis.

Adhesive strapping is used chiefly for a fracture of one or more ribs.

Splints should be light in weight but firm enough to give support. Anything—an umbrella, cane, or folded pillow, etc.—which will serve this purpose may be used in an emergency, but splints of soft pine or basswood are best. They should be wider than the part, if possible. Splints should be long enough to fix the joints above and below the fracture. For instance, in a fractured humerus, a splint applied to the outer surface of the arm should extend from the shoulder to the tip of the flexed elbow. For a fractured forearm, the splint should extend from the elbow to the base of the fingers or to the finger tips depending upon the seat of the fracture. The hand and fingers must never be left in a cramped position. Sometimes the fingers are left free to allow free movement of the joints. Some surgeons, however, always include and support the hand by the splint in order to prevent swelling, discomfort and pain. The fingers are left exposed so that disturbances in the circulation may be observed. The arm is placed across the chest with the palm inward and thumb up and is supported in a sling. This keeps the bones apart, prevents union and in case of partial loss of function the arm and hand are in a useful position. For a fractured femur, the outer splint should extend from the axilla to below the foot. For a fracture of the lower leg, the splints should extend from above the knee to below the foot. Two or more splints should be used to support a limb where possible.

Splints must always be well padded, especially over tender areas, over bony prominences such as the shoulder, elbow, wrist, hip, knee or ankle and also in hollows such as the axilla, flexed elbow or groin. They may be held in place by straps of adhesive or by a bandage but must never be applied too tightly. If not well padded or if applied too tightly the pressure will cause swelling, pain, blisters, ulcers, sloughing of tissues and may result in paralysis or a permanent impairment of function.

In applying splints to the arm or leg, hollows, such as the palm of the hand and under the knee, should always be well padded. In the hand this support prevents discomfort and maintains its normal arch. In the treatment of a fractured femur the knee is always slightly flexed. This prevents the knee from sagging backward and maintains the normal anterior bowing of the femur. Proper support relieves the pain due to strain and stretching of the tendons.

Before splints are applied the part should be very carefully and gently cleansed, dried and powdered.

Sandbags, when placed at either side of the injured part, are of service in preventing the twitching of muscles or movement of the part.

Reduction and Immobilization of the Fracture.—In all cases the fracture should be reduced as soon as possible in order to prevent overriding or overlapping of the broken ends with further injury to the periosteum and other tissues, etc. Some bones also, such as those of the nose, tend to unite quickly so if not promptly and properly reduced will result in deformity. Sometimes the fracture may be reduced, that is, the bones may be brought approximately into apposition, by very gentle manipulation and immobilization secured by means of bandages, adhesive strapping or splints of wood, metal, or plaster-of-Paris. Splints or casts of plaster-of-Paris are usually used when it is difficult to keep the part at rest and absolute fixation is necessary, as in a fracture of both bones of the forearm or leg. Molded casts of plaster-of-Paris are frequently used for the extremities. A shoulder spica is frequently used for a fractured arm, a hip spica for a fractured femur and a body cast or jacket for a fractured spine or pelvis.

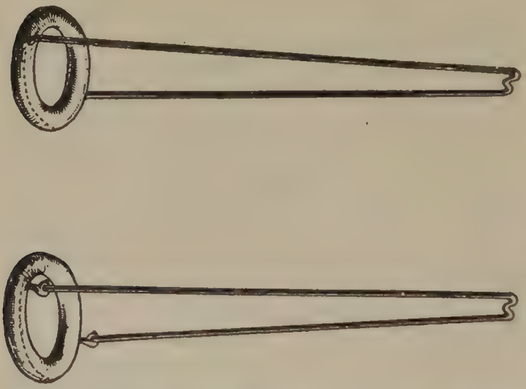


Fig. 141.—The Thomas Traction Arm Splint. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

Usually an anesthetic is given to avoid pain, relax the muscles and allow the surgeon to work to the best advantage. Frequently pain, swelling, or muscular rigidity make it difficult to determine the exact position and nature of the fracture so that replacement must be done under a general anesthetic and under the guidance of the X-Ray. The patient is kept under observation and the part examined again under the X-Ray to verify the position and observe the process of repair.

Many fractures for various reasons cannot be reduced by simple manipulation or the bones maintained in their proper position. In such cases reduction and fixation must be secured by open operation, or gradually by means of traction or traction combined with suspension obtained by the use of various external appliances. The latter method was used extensively and many improvements were developed in the treatment of fractures during the past war.

Traction is the "extension of the member in what may be called the physiological direction and position." It is used when the broken ends of bone are overlapping thus causing lateral deformities and shortening of the limb. Its object is to prevent overlapping of the bones and thus prevent deformities. Traction is accomplished by the use of weights, by using the weight of the patient, and by the use of various splints. The traction pull may be on strips of adhesive attached to the skin as in the Buck's extension used for a fractured femur. It may also be made on a stocking or gaiter glued to the foot or by means of the Sinclair skate. For fractures of the arm traction is sometimes made on a cotton glove glued to the hand. The splints commonly used are the Thomas traction arm splints, the Jones traction humerus splint, the Jones wrist splint, the Thomas traction leg splint and the Hodgen leg splint (a suspension splint), or modifications of these.

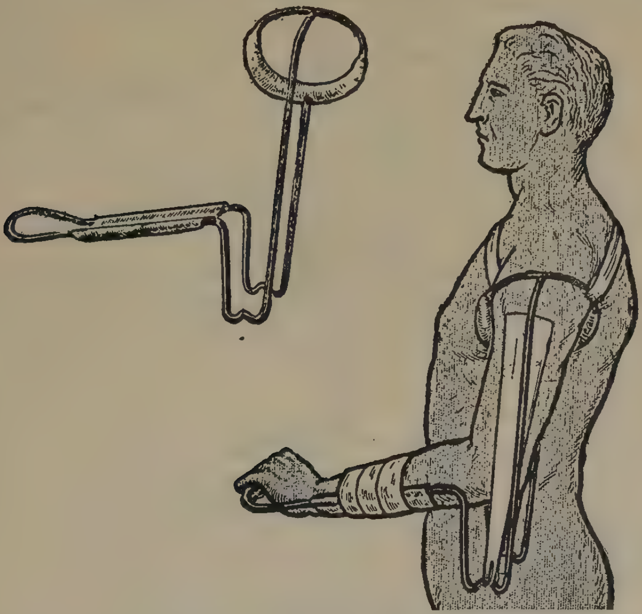
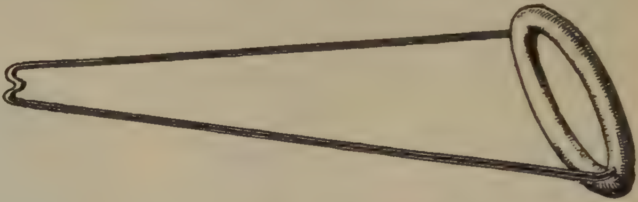


Fig. 142.—The Jones Traction Humerus Splint. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

A nurse should be familiar with the various appliances used and the articles necessary for their application and should see that the part is properly prepared. Before traction is made by means of adhesive strapping, etc., attached to the skin the part should be shaved, cleansed and thoroughly dried. Extreme care and gentleness in handling must be used.

Buck's extension is not used as frequently as in the past but a nurse may have to collect the articles necessary for its application. Briefly, they are as follows: A fracture board to render the mattress firm; blocks if necessary to elevate the foot of the bed: two pieces of moleskin (about four inches wide and long enough to extend from the side of the foot to above the knee) with suspender-buckles attached; a spreader consisting of a piece of wood five inches long by three inches wide to which is attached a strip of webbing about one inch wide and long enough to extend about six inches on either side, so that they may be fastened to the suspender-buckles; a piece of rope which is passed through a hole in the spreader and securely knotted, a pulley (with screws to attach it to the bed) over which the rope is passed, and weights suspended on the rope by means of which traction is made. Matches and an alcohol lamp will be necessary to heat the moleskin so as to make it adhere. Gauze bandages may be used to secure the moleskin firmly. A splint may be used to support the limb, to prevent eversion of the foot and the toes from turning out (the characteristic deformity in a fractured femur), and to slightly flex the ankle to prevent stretching of the tendons with a resulting "drop foot" and impaired



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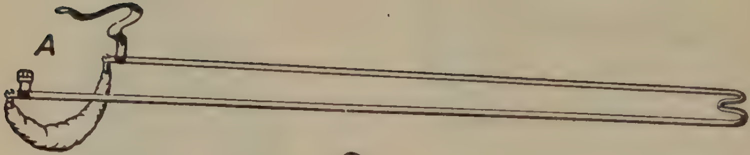

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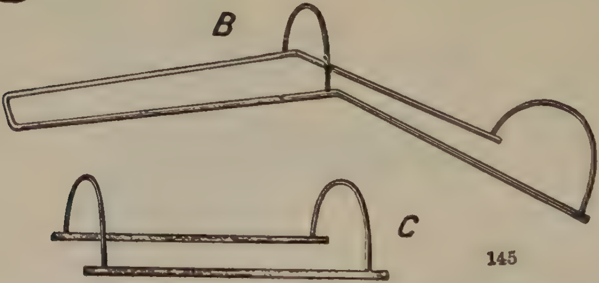

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FIG. 143.—THOMAS TRACTION LEG SPLINT. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

FIG. 144.—HALF-RING MODIFICATION OF THE THOMAS TRACTION LEG SPLINT. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

FIG. 145.—HODGEN'S LEG SPLINT. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

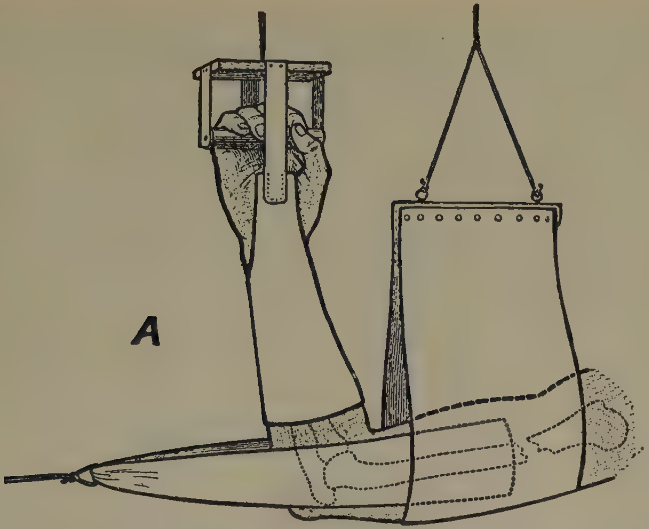

Fig. 146.—Principles of Suspension and Traction for Fractures of the Humerus. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

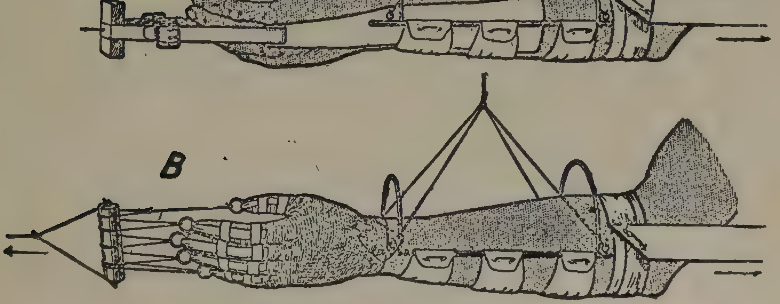

Fig. 147.—Suspension Cradles for Fractures of the Radius and Ulna, and Methods of Installing Traction and Counter-traction. A, Traction by Means of Glued or Adhesive Strips. B, Sinclair's Method of Using a Cotton Glove Glued to the Hand. (From Blake's "Gun-shot Fractures of Extremities," D. Appleton & Co., Publishers.)

function of the ankle. Muslin bandages will be required to secure the splint and non-absorbent cotton for padding.

Suspension combined with traction is secured by placing the limb in a cradle (such as the Hodgen's splint for the lower extremity) and suspending it from an overhead frame to which are attached the suspension pulleys and hand grasps. The frame may be provided with a trolley attachment as shown in Figure 149. Traction is applied by weights attached to a cord which runs over a pulley. The weight of the patient may be used by elevating the foot of the bed. The limb is placed in the position which will best provide rest for the muscles causing the displacement and deformity.

The *advantages* of this method of treatment are that (1) It insures a better circulation, therefore promotes healing and lessens the danger of bedsores. (2) It allows motion in the joints without interfering with the proper relation of the broken ends of bone and so prevents stiffness of the joints and loss of function. (3) It allows the frequent application of dressings, massage or other treatments. (4) The patient may be propped up in the vertical or semi-recumbent position and by means of the hand grasps may turn and lift himself so that the linen may be easily changed and the back massaged and properly cared for: The danger of pneumonia is also lessened. (5) The patient has less pain and is much more comfortable. (6) The fact that the patient can himself help by systematic exercise of the joints has a beneficial effect on his mind and therefore on his recovery and general health.

The Open Treatment of Fractures.—When a satisfactory reduction of a fracture cannot be made and maintained by the above methods incisions must be made and some internal means of fixation such as plates, sutures, wires, screws, nails or bolts, or an inlay of bone graft must be used.

The After-Care and Responsibility of the Nurse.—The after-care is a very important factor in securing a prompt, satisfactory recovery from a fracture. A nurse should have an intelligent appreciation of what Nature and the surgeon are trying to do and should strive to help them reach this goal.

Prompt recovery depends to a large extent on the general mental and physical health of the patient. It must be remembered that the mind of the patient is not ill but is active and craving something to do during the long days or weeks. It will become ill if the nurse does not minister to mind as well as body. The patient must not be allowed to become depressed, for a depressed brain means a slowing up of all body functions—the secretions, digestion, circulation, and repair all become sluggish. Old people and patients suffering from a fractured pelvis, spine or femur particularly require cheer and encouragement.

The general hygienic care and the diet are equally important. A well-nourished body is prepared to fight disease or infection and to repair tissue so a nurse should see that meals are appe-

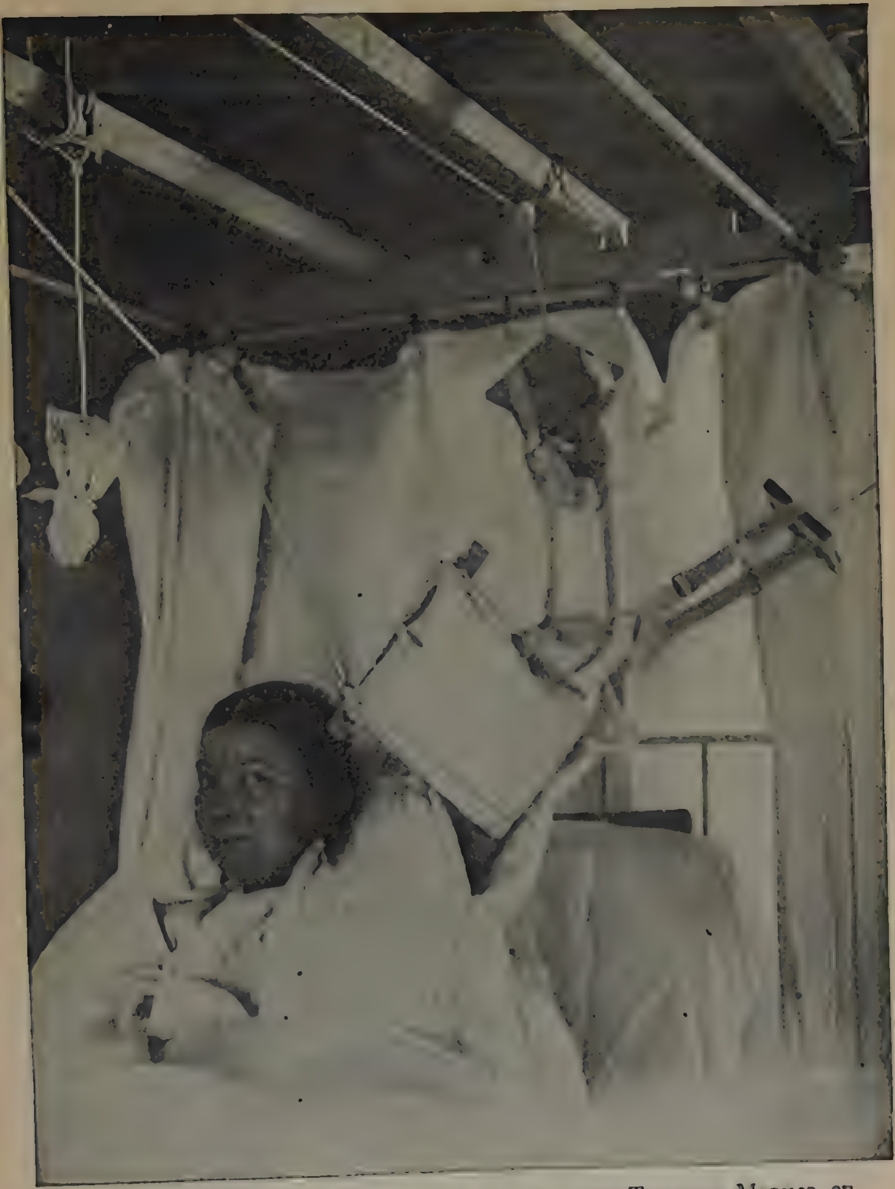

Fig. 148.—Showing Balanced Suspension and Traction Method of Treating a Fracture of Neck of Humerus. Patient exercising the elbow-joint. (Courtesy of Henry H. M. Lyle, M.D., St. Luke's Hospital, N. Y., Annals of Surgery, Publishers.)

tizing and of good building material. Rest, sleep, comfort and freedom from pain should be secured if possible. Cramped positions should be avoided. Pressure-sores from poor circulation, splints, casts, or other appliances, friction of clothing or lying too long in one position must be guarded against. Complications such as bedsores and pneumonia are to be particularly guarded against in old people.

A nurse must see that bandages, casts, etc., are neither too tight nor too loose. Symptoms of interference with the circulation or nerve supply must be watched for and reported immediately. She should see that the mechanical apparatus and weights, etc., are properly adjusted. The supporting straps of cradles must be kept taut and smooth in order to give even support. If the support is uneven or slackened the patient suffers from severe pain. When a Buck's extension is used the hollow under the knee should be supported to relieve strain on the tendons and when the heel and leg are elevated the whole leg should be evenly supported. Cradles should be used over the part where necessary to protect it from the bedclothes. The part must not be allowed to become cold. In carrying out treatments or dressings, etc., the part must not be disturbed and in doing dressings the bed should be protected to avoid soiling and unnecessary changing of linen. Care must be taken in the use of the bedpan in fractures of the spine, pelvis and femur.

Active motion of the adjacent joints (by the patient) which does not endanger the proper position of the fragments is of the greatest importance in stimulating repair and in preventing atrophy of the muscles and stiffness of joints. It is usually begun after the first twenty-four hours. A few days of fixation will often cause irreparable stiffness. Patients are frequently too indolent or do not understand the importance of this exercise so the nurse must explain and encourage the systematic carrying out of instructions given by the surgeon. The restoration of function, the coördination of muscular movements must come to a large extent through re-education. The patient must learn again to make the various movements with his fingers, hands and arms, etc., which will be useful and necessary in his daily life. To accomplish this his mind must *will* to do so and must consciously direct the movements of separate muscles and the coördination of groups of muscles in the regular practice of the exercises prescribed by the surgeon.

Massage is one of the best means of stimulating repair, of preventing atrophy of muscles and stiffness of joints and tendons. It stimulates an inflammatory reaction, producing a constant supply of healing blood and a prompt withdrawal of waste products. It is applied regularly every day as soon as union is secured and there is no danger of displacement. Pupil nurses are not, as a rule, however, required to give massage in such conditions unless they have had special training and experience.

When repair is delayed, dry heat in the form of baking or an

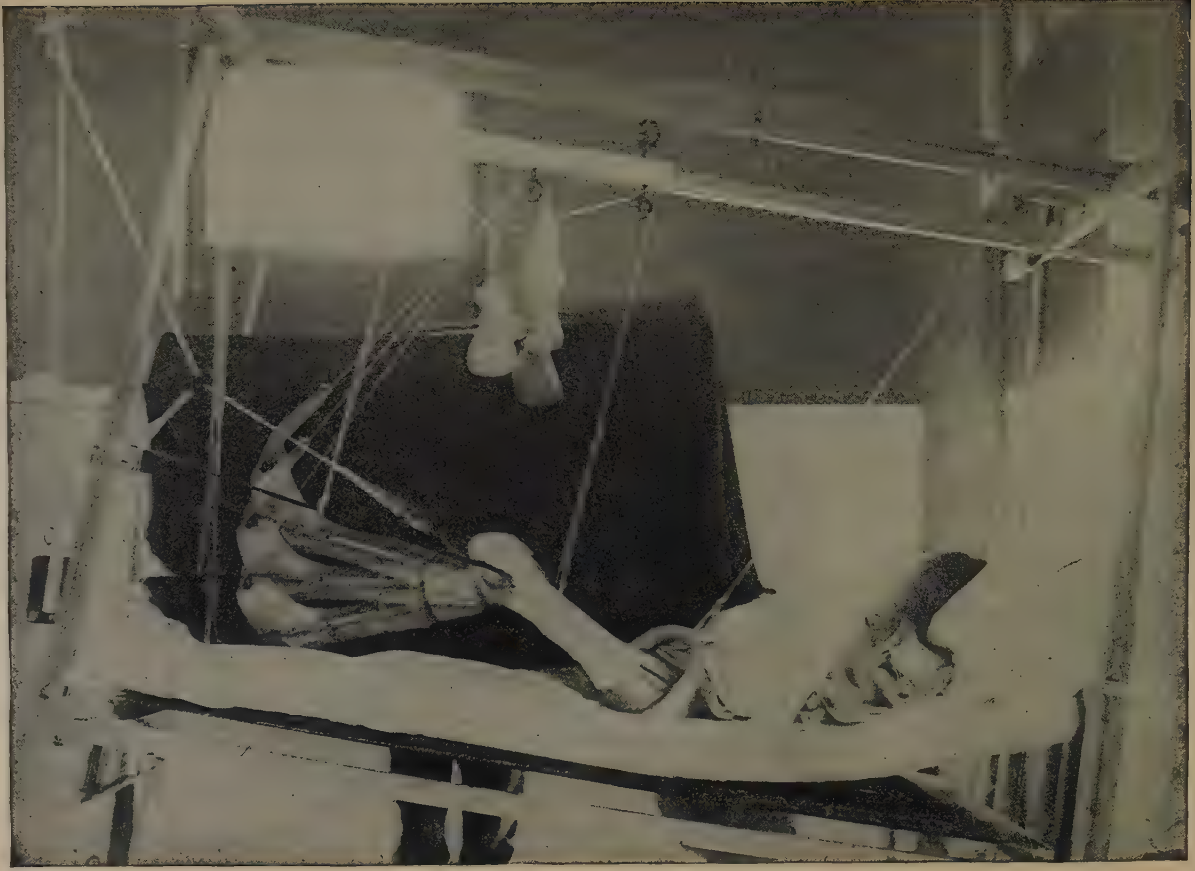

FIG. 149.—SUPERIMPOSED PICTURE TO SHOW THE RANGE OF MOTION OBTAINED IN EXERCISING THE KNEE-JOINT. (Courtesy of Henry H. M. Lyle, M.D., St. Luke's Hospital, N. Y., Annals of Surgery, Publishers.)

electric pad is sometimes used to stimulate the circulation and hasten repair. The part is sometimes soaked for fifteen to twenty minutes in hot water several times a day. Radiant light and heat, and medical diathermy are used (see Chapter XVI) to stimulate the vital activity of cells, to hasten recovery and the restoration of the patient to his family and former social and economic place in the community.

PART II-C

NURSING IN THE PREVENTION AND CURE OF DISEASES OF THE EYE, EAR, NOSE AND THROAT

INTRODUCTORY

Opportunities for Serving and Learning. — Frequently patients are admitted to our general medical and surgical wards with physical defects or diseases of the eyes, ears, nose or throat. The handicap to the individual of such defects or diseases, the social and economic loss, and the effect of such handicaps on the general health and welfare of the individual are increasingly recognized and emphasized, not only in the public health program in schools and communities, but in the general wards of our hospitals. No longer is it considered sufficient to treat a patient merely for the specific surgical or medical condition which brings him to the hospital, for the above factors and the interplay of all the bodily functions on health are now recognized. More and more the aim is to treat the *patient* as a whole rather than the disease, and to restore him to complete mental and physical health. Too much emphasis cannot be laid upon the responsibility of the nurse in the early recognition, prevention, and treatment of such defects or diseases when such vital issues as the patient's sight or hearing, as well as his general health and welfare, may be at stake. Knowledge, skill, and a keen appreciation of these vital issues are essential.

CHAPTER XXXVII

NURSING CARE AND TREATMENTS USED IN DISEASES OF THE EYE, EAR, NOSE AND THROAT

Frequently in the care of patients in the general surgical or medical wards of a hospital treatments to the eyes, ears, nose or throat are required. Only such treatments can be discussed in a text on general nursing.

Treatments to the Eyes

A nurse may be required to assist a doctor with an examination of the eyes and to give treatments, such as the application of hot or cold compresses, irrigation of the conjunctival sac, the application of ointments, etc., and the removal of foreign bodies.

The eye is such an extremely sensitive and delicate organ and any interference with its function is such a serious handicap that every precaution should be taken to prevent mistakes or accidents in the nursing care. Before giving treatments or applying remedies nurses should understand the anatomy of the eye, the disease from which the patient is suffering, the complications apt to develop, the purpose of the application or treatment, and the dangers and discomforts involved in the procedure. Knowledge, skill, delicacy in handling, gentleness, firmness of touch and the most thorough, expert care are required.

Examination of the Eyes.—The *objective examination,* that is, examination by sight or inspection and by feeling or palpation, may be conducted in daylight or in a dark room with artificial light by means of oblique illumination (the light at the side and focused on the part examined with a strong convex lens), or with the ophthalmoscope. The duties of the nurse consist chiefly in placing the patient and the light in the proper position and in providing the necessary instruments. These are the lens, ophthalmoscope and tonometer. The lens is used in examining the anterior structures of the eyeball such as the cornea, anterior chamber, iris and lens. The ophthalmoscope is used to examine the interior of the eye. Changes in the internal structures of the eyes occur in various systemic diseases so that an examination with the ophthalmoscope is often of great assistance in making a correct diagnosis. The tonometer is an instrument for testing the tension or the pressure within the eyeball.

Position of the Patient in Relation to the Light.—For examination in daylight the patient is seated (in some cases is allowed to stand) facing a window. For examination in a dark room with artificial light, by means of a lens, the patient should be seated in front of the examiner. The *light* should be about *18 inches* to the side of the patient, on a *level with the eye* and *several inches in advance.* The light may be on either side of the patient.

In examination with the ophthalmoscope, the patient is seated facing the examiner. The *light* is placed on either side of the patient, several inches to the side and behind so that the light strikes the patient's temple leaving the face in darkness (Dr. May). The light shines into the mirror of the ophthalmoscope and is reflected into the eye of the patient.

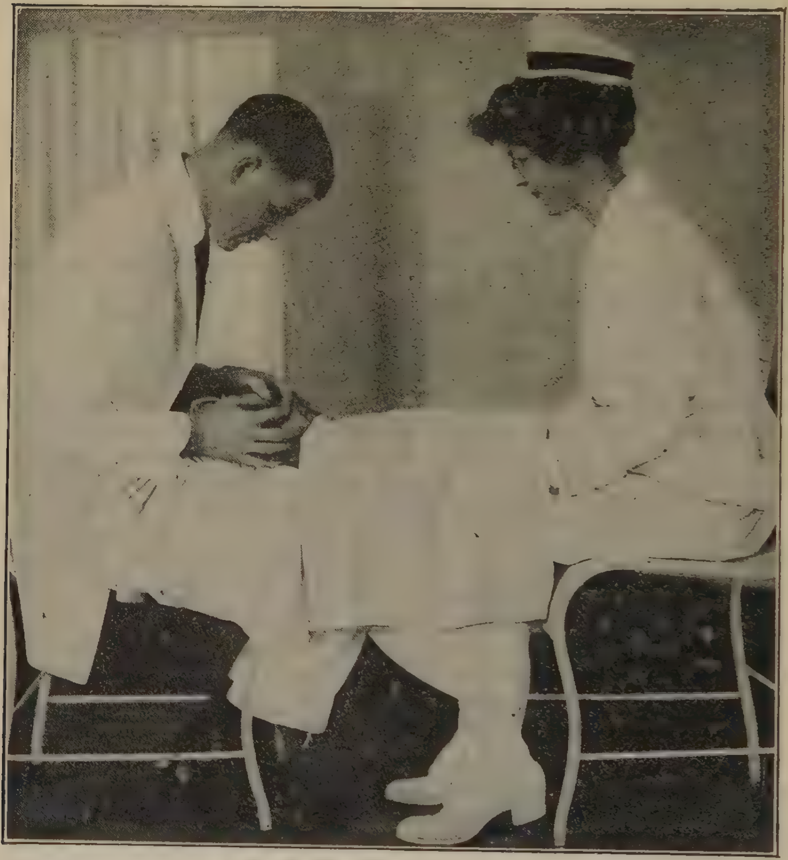

FIG. 150.—SHOWING METHOD OF RESTRAINING A CHILD FOR AN EXAMINATION OF THE EYES.

In an examination of the eyes of an infant or child who resists examination, the child should be placed on its back across the lap of the nurse so that its head rests and is steadied between the knees of the doctor, who sits opposite. The nurse should hold the child's hands, and steady its body with her arms supporting the back and neck, but allowing the legs to remain free so that when it struggles, the movements will be confined to the legs while the head remains fixed. These precautions are necessary not only to aid in the examination but in order to avoid accidental injury to the eyes. One should always guard against the danger of pent-up secretions squirting into the eyes of the nurse or doctor as the tightly closed lids are separated.

Instillation of Drops.—Drops of various solutions are instilled into the eyes for purposes of examination and in the treatment of diseases.

Instillation for Purposes of Examination.—To examine the interior of the eye it is necessary that it should be completely at rest. By instilling drops of certain drugs it is possible to dilate the pupil and prevent it from reacting to light. Such a drug is called a *mydriatic.* The two drugs commonly used are atropin sulphate and homatropin hydrobromate. These drugs also paralyze the muscles of accommodation—muscles within the eyeball which control the curvature of the lens and make it possible to focus rays of light from objects at varying distances and thus to see them clearly. Such drugs are called *cycloplegics.* For purposes of examination, two or three drops are placed in the eyes every ten minutes for two or three doses until the pupil is sufficiently dilated.

Atropin is also commonly used in the treatment of inflammatory diseases of the eyes. The effects of atropin are (1) to dry up secretions and thus relieve congestion, swelling and pain; (2) to deaden sensory nerve endings producing a sedative effect; (3) to put the eye completely at rest, so promoting healing; (4) to dilate the pupil and prevent or break down adhesions. When the pupil is contracted or only slightly dilated, the iris rests against the anterior surface of the lens. An inflamed iris if allowed to remain in this position would cause adhesions to form and interfere with the reaction of the eye to light or to accommodation and, therefore, with the sight. When the pupil is dilated the iris hangs free in the anterior chamber.

In some people the continued use of atropin causes a marked local irritation with redness, swelling and itching of the eyelids. Some people also are very susceptible to this drug and in these its use may cause general symptoms of poisoning—dryness of the mouth and throat, difficulty in swallowing, nausea and vomiting, skin eruptions, flushing of the face, headache, loss of vision, dizziness, excitability and delirium. All patients should therefore be watched for symptoms of local irritation or of general poisoning and any such symptoms should be reported at once.

Sometimes drops are instilled into the eye to counteract the effect of atropin, that is, to contract the muscles of accommodation and the sphincter muscles of the iris. Such drugs are called *miotics.* They contract the pupil and reduce intraocular tension. The drug most commonly used is eserine.

Method of Procedure in the Instillation of Drops.—An eye-dropper is usually used for the instillation of drops. In drawing up the solution from the bottle care should be taken to avoid wasting the drug by drawing up more than required. Excess solution should not be returned to the bottle for fear of contaminating it.

To instil the drops, the head of the patient should be slightly tilted backward. Gently separate the lids, draw down the lower lid with the left hand, ask the patient to look up, then allow the drop to fall on the center of the everted lower lid. The drop should not be allowed to fall on the sensitive cornea. This is unnecessary, startling and very disagreeable. The dropper should not be allowed to touch the lashes, lids or eyeball, both to avoid irritation, and, also, to avoid contamination of the dropper. The lids and cheek should be gently dried from the overflow of the drug or secretions. When the lids are closed the drops will be distributed. A cotton pledget should be held over the inner angle of the eye to prevent the drug from being lost down the lacrymal duct.

The same dropper should never be used for different solutions without first a thorough cleansing in order to avoid mixing and thus spoiling the solution. All drugs used in the eyes should be watched for changes in the color or for the formation of a sediment, showing decomposition. Some drugs are changed by the action of light or by heat or by contact with organic matter such as the rubber on the medicine dropper. Such drugs should be kept in dark bottles, in a cool place, and contact with the rubber should be avoided.

The Application of Compresses.—The circulation in the eyeball or eyelids may be controlled by applications, either hot or cold, chiefly through their effect on the supra-orbital branch of the ophthalmic artery. Another branch of this artery supplies the retina, the delicate membrane containing the nerves of sight. Again other branches supply the nasal cavity, ethmoid cells, eyelids, muscles and tissues around the eyeball. The aim in all applications is to affect the circulation in the diseased area under treatment without unnecessarily interfering with the circulation in the surrounding parts such as the nasal cavity or cheek, etc. Thus *hot applications* to the lids extending over the forehead (but not over the cheek) will dilate the supra-orbital artery and drain the other branches of the ophthalmic, thus relieving inflammation and congestion of the eyeball. This is the area to be covered, therefore, in relieving inflammation and congestion of the eyeball. Cold applications over this same area, by contracting the supra-orbital artery, would increase the blood supply in other branches and thus cause congestion in the eyeball. This might rupture the delicate blood vessels in the eyeball and cause loss of sight. Cold compresses are usually contraindicated in inflammatory diseases of the eyeball. When used for inflammation of the eyelids, they are allowed to cover the eyelids and extend over the cheek, but not over the brow.

In inflammation of the eyelids, hot applications are allowed to cover the eyelids and extend over the cheek but not over the eyebrow or over the nose. Heat applied to the latter area would increase the congestion in the eyelids and cause congestion in the nasal cavity and ethmoidal cells, thus predisposing them to infection and disease.

Application of Hot Moist Compresses.—Hot compresses are applied in inflammatory conditions of the eyelid or eyeball—the cornea, iris or ciliary bodies, etc.

The *effects* of the moist heat are the same here as in other inflammatory conditions (see effects of moist heat, Chapter XVI) but the eye requires special care on account of its delicacy and the importance of its function.

Method of Procedure.—The patient should be in bed in the dorsal recumbent position and at the side of the bed. A towel is placed across the chest.

The necessary *articles* are brought to the bedside. These consist of the compresses, electric stove, basin of water or boric acid and a thermometer to test the solution. The compresses are made of gauze, cotton or lint and should be light but thick enough to retain the heat and moisture. There must be no rough edges or loose threads.

The *size* of the compress and *area* to be covered depend upon the purpose of the application. When applied for *inflammation of the eyelids*, the compress should be large enough to cover the eyelids and extend over the cheek but not to cover the eyebrow or extend over the nose. When applied for *inflammation of the eyeball*, they should be applied over and above the eye extending to the forehead. They should extend over the brow but not over the cheek. (See anatomical factors.) The compresses are applied over the closed lids.

The *temperature* should be as hot as can be borne (115° to 120°) and should be tested with a thermometer. All excess water must be removed to avoid the danger of scalding. To avoid blistering, when the lids are tender, vaseline should first be applied to the lids or the pads may be applied over oiled silk.

The *application* should be made with a firm, sure touch but gently, avoiding the slightest pressure on the lids or eyeball. When applied the pads should be scrupulously clean, also smooth and pleasant to the touch.

The *duration* of the application varies. The pads are usually changed every thirty to sixty seconds for ten to fifteen minutes each hour. Longer or more frequent applications may cause blistering and paralysis of the blood vessels.

On *removal*, the lids should be gently dried. Any moisture allowed to remain will evaporate, drawing heat from the eyelids and leaving a sensation of chilling and pain.

Any *discharge* from the eyes should be considered contagious. When present, each eye should be treated separately. The compresses should not be used a second time but should be handled with forceps and burned.

Application of Cold Compresses.—Cold compresses are used in inflammatory diseases of the eyelids and conjunctiva. They are not applied in diseases of the eyeball on account of the danger of limiting the blood supply, lowering the resistance of the tissues and preventing healing. Cold is also only applied to the lids when they are red, showing an active circulation. When mottled, it shows a stasis or slowing up of the circulation, in which condition the doctor may order hot applications.

The *effects* of the cold are the same here as in other inflammatory conditions, but, as in applying hot compresses, special care must be taken.

Method of Application.—The patient should be lying down in a position of rest. A towel should be draped across the shoulders.

The necessary *articles* should be brought to the bedside. These are compresses, a basin containing a block of ice and a small amount of water or a basin of boric acid to moisten the compresses. The compresses should be made of lint, gauze or soft muslin, the thickness depending upon the material used but thick enough to retain the cold. There must be no rough edges or loose threads.

The *size* of the compress should be sufficient to cover the closed eyelids and extend over the cheek but not over the brow in order not to congest the eyeball.

Before applying, they should be moistened and arranged on the ice in rows to chill, then used in order. When applied they should be cold and moist, but not moist enough to allow water to run over the cheek.

The *duration* varies. They should be changed every 15 to 30 seconds as after that they are no longer cold, being warmed by heat from the eyelids. When applied over an extended period it is wise to use vaseline to prevent injury to the tissues.

Applications of Compresses in Gonorrheal Ophthalmia, Ophthalmia Neonatorum and Other Acute Infectious Diseases.—Gonorrheal ophthalmia and ophthalmia neonatorum (gonorrheal infection of the new-born infant) are both very serious infections threatening the loss of sight and are highly contagious. The most expert care is necessary to prevent complications and loss of sight and to prevent the spread of the infection to the nurse, to other patients or to the patient's other eye, if not already infected.

To protect herself and other patients, the nurse should wear a gown, rubber gloves and goggles to prevent any discharge from spurting into her own eyes when cleansing the lids. The patient should be completely isolated from others and all articles used by and for him should be kept separate from others. The pillow should at all times be protected by a rubber case. During treatments a rubber dressing sheet covered with a towel should be arranged across the patient's shoulder so as to protect the bed linen, etc. Compresses or pledgets used to cleanse the eyes should never be used a second time. They should be placed immediately in a paper bag and later destroyed by burning. It is wise to handle all soiled compresses, etc., with forceps. All utensils, rubber gloves and other articles used for treatments to the eyes should be sterilized immediately after use. All linen should be disinfected before being sent to the laundry or placed in a separate hamper to be disinfected in the laundry. After sterilizing all the articles used in the treatment and before attending to another patient, the nurse should discard gown, gloves, and goggles and thoroughly disinfect her hands. She should at all times avoid touching her face or eyes with her hands.

To protect the patient's other eye if uninfected, it should be covered with a Buller's shield. The patient should lie on the affected side, or on his back, always so as to aid drainage from the outer angle of the eye and prevent any discharge from flowing over the nose into the other eye. The non-affected eye should be watched closely for symptoms or signs of inflammation.

Irrigations of the Conjunctival Sac.—Irrigations are given in various forms of inflammation of the conjunctiva (conjunctivitis) for cleansing and antiseptic effects. The conjunctiva is a continuous, thin, transparent layer of mucous membrane lining the eyelids and covering the anterior surface of the eyeball. On account of its exposed condition it is liable to irritation from wind, smoke, dust and foreign bodies, etc., and to infection by microörganisms. The many blood vessels account for the "bloodshot" eye when the conjunctiva is irritated and inflamed. On account of its rich supply of blood vessels, lymphatics, mucous glands and lacrymal ducts, the conjunctiva, when irritated or infected, is liable to marked congestion and swelling with a marked increase in secretions so that the lids become tender, edematous, adherent and difficult to separate. (In this condition they are easily injured by unskillful handling.) The part also becomes very sensitive and painful on account of its numerous nerve supply, especially when an ulcer or foreign body, etc., is under the lid. The secretions of the conjunctival sac drain through the lacrymal or tear duct into the nasal cavity.

Eversion of the Eyelids.—This is a necessary procedure not only in irrigations of the conjunctival sac but in examinations, in the removal of foreign bodies, and in the application of remedies to the conjunctiva and eyeball. It is therefore one of the first procedures a nurse should learn in the treatment of diseases of the eyes. Eversion of the lower lid is quite a simple matter. Eversion of the upper eyelid is more difficult and requires some practice. Student nurses may practice on each other. The following directions are taken from a text prepared by the Manhattan Eye, Ear and Throat Hospital:

To Expose the Conjunctiva of the Lower Eyelid: "Place a finger or thumb upon the lower lid, just below the lashes, and direct the patient to look upward and at the same time press downward with a finger, and the edge of the lid will roll outward, exposing the conjunctival surface."

To Expose the Conjunctiva of the Upper Eyelid: "First direct the patient to look downward without inclining the head forward, and at the same time grasp the lashes of the upper lid between the thumb and forefinger of one hand, and with the other hand place a small pencil, penholder, or applicator horizontally along the upper part of the lid. Then draw the lid downward and forward and at the same time press the pencil or applicator downward with the other hand. After practicing until it is easy to turn the lid by this method, a finger may be substituted for the pencil and, perhaps, after a time sufficient skill may be acquired so that the lid may be turned with one hand alone without the assistance of the other hand. The nurse may stand either behind the patient or in front.

"The majority of the patients when told to look downward will incline the head forward without relatively changing the position of the eyes. It is, therefore, necessary to impress upon the patient that he must turn the eyes downward without moving the head, and, moreover, he must continue to look downward as long as it may be necessary to keep the lid everted, because if the patient looks upward suddenly, even after the lid has been successfully turned, the lid will be immediately turned back to its natural position. The reason for this will be seen from what we have learned under the anatomy of the eye, that the conjunctiva which lines the lid is continuous with that which covers the front of the eyeball, and, therefore, when the eye is turned upward the conjunctiva of the upper lid is also drawn upward, and the tension on the conjunctiva causes the lid to turn inward."

Method of Procedure in Irrigation of the Conjunctival Sac.—The *articles* required are the solution ordered, an irrigator, a basin for the return, cotton pledgets and paper bag.

The *solutions* used are boric acid 2 per cent., or sodium chlorid one dram to a pint. Bichlorid of mercury 1 to 10,000 is sometimes ordered but is used with caution. Other disinfectant solutions such as formalin 1 to 2000, potassium permanganate 1 to 5000, mercurochrome 1 to 2 per cent., and acriflavine 1 to 4000 are occasionally used in purulent conjunctivitis. Boric acid is most commonly used. It is mildly antiseptic, bland and soothing and may be used quite freely without irritation.

The *temperature* of the solution should be lukewarm.

The *irrigator* used may be absorbent cotton, an eye dropper or sometimes a soft rubber bulb or the undine.

The *patient* should be seated comfortably in a chair or, if in bed, in the dorsal recumbent position with the head turned slightly to the side to be irrigated. When the patient is a small child it may be necessary to wrap him firmly in a sheet in order to keep his hands away from his eyes and prevent resistance to and interference with the treatment, and possible injury to the eyes owing to sudden, violent movements. No treatment to the eye should be attempted unless the *light* is sufficient to see exactly what you are doing, but avoid having it shine directly into the sensitive eyes of the patient. The patient's shoulder should be protected with a towel.

The *nurse*, when possible, should stand behind the patient. The patient holds the basin under his chin or to the side of his face and may hold a cotton pledget to direct the return into the basin. (This, however, is not advisable when the discharge is infectious as in gonorrheal ophthalmia.) The head is inclined to the side irrigated, slightly tilted backward and may rest against the nurse when the patient is sitting up.

Before irrigating, the lids should be carefully cleansed to remove any secretions or particles of dust adhering to the lashes which would otherwise be carried into the sac. The lids should be gently but well separated with the thumb and fingers of the left hand so that the fluid will reach all parts of the membrane. In separating the lids all pressure on the eyeball is to be avoided —pressure is made on the cheek and brow. In irrigating, just sufficient force to dislodge the secretions should be used. The fluid should always be directed from the inner angle of the eye so that it will flush the sac and remove the secretions from the outer angle of the eye. The fluid and discharge must not be allowed to flow down the lacrymal duct to the nose. This would probably cause irritation and obstruct the duct and when the discharge contained microörganisms would spread the infection. Avoid touching the eye with the irrigator.

When the sac has been thoroughly flushed and all secretions are removed the lids should be cleansed and dried. Moisture left on the lids causes evaporation and chilling and predisposes to inflammation and congestion.

Irrigation of the Conjunctival Sac in Gonorrheal Ophthalmia, Ophthalmia Neonatorum and Other Acute Infections.—The same vigilance is observed as in the application of compresses to prevent the spread of the infection to the nurse and other patients or to the non-affected eye. If, by accident, a drop of pus should spurt into one of the nurse's eyes, immediate steps should be taken to prevent serious consequences. A very short time is sufficient to cause serious damage and neglect may result in loss of sight. The conjunctiva lining the upper and lower lids should be exposed and the sac thoroughly irrigated with one of the germicidal solutions previously mentioned. A few drops of argyrol 25 per cent. or of a 2 per cent. solution of silver nitrate should be instilled into the eye. The other eye should be protected until all danger of infection is passed.

In irrigating the eye, to prevent complications, extreme care and gentleness must be used in separating the tense, inflamed and swollen lids. Pressure on the eyeball and injury to the cornea must be avoided. Irrigation must be as thorough as possible. Recovery depends upon the thorough cleansing and removal of the secretion as rapidly as it is formed.

Application of Ointments.—Antiseptic or irritant ointments are frequently applied to the eyes in inflammatory diseases of the lids, conjunctiva, or cornea.

Method of Application.—The lids must be cleansed of all secretions or discharges before the application is made. All scales or crusts should be removed. A solution of borax (about half a teaspoonful in a cupful of hot water) will soften the crusts and aid in cleansing. The ointment may then be applied to the margin of the lids with a glass rod or spatula or with cotton on a tooth-pick or applicator. If intended for the conjunctiva or cornea the ointment may be applied to the everted lower lid or the lids may be slightly separated and the ointment may be placed or wiped off the spatula between the lids. In this way it is introduced into the conjunctival sac. Gentle massage of the lids will help to spread the ointment over the surface of the eyeball. Ointments may be obtained in tubes and applied directly.

Application of Powders.—Antiseptic and irritant powders such as iodoform and calomel, are dusted into the eye to prevent the action of germs and to stimulate the healing of ulcers of the cornea. It is said that the calomel ($HgCl$) slowly combines with sodium chlorid ($Na\ Cl$) in the tears and forms bichlorid of mercury ($Hg\ Cl_2$) and in this way keeps the eye bathed in an antiseptic fluid.

Method of Application.—The lids should first be cleansed of all secretions. They are then gently separated. The powder is dusted into the eye with a camel's-hair brush, or from cotton wound on a tooth-pick or applicator. The lids should be closed afterwards. As the powder is irritating, the tears may flow freely. Any excess should be wiped from the cheek or lids. A child must be prevented from rubbing the eyes.

Application of Solutions.—Antiseptic, astringent, caustic and disinfectant solutions are painted or brushed on the everted lids in inflammatory diseases of the conjunctiva or applied directly to infected corneal ulcers.

Removal of Foreign Bodies from the Eyes.—Foreign bodies such as dust, iron, coal or ashes may be carried into the conjunctival sac or may adhere or become embedded in the cornea. When in the conjunctival sac they usually adhere to the inner surface of the upper lid. A nurse may remove a foreign body from the conjunctival sac by everting the lids and brushing it off with sterile cotton wound around a tooth-pick. Before attempting to do so she should see that her own hands are clean and that the light is good so that she can see exactly what she is doing. After the removal of the foreign body a drop or two of argyrol may be instilled to prevent possible infection. If the foreign substance cannot be removed in this way it is probably embedded in the cornea. A nurse should then never attempt to remove it but should call the assistance of an expert surgeon.

Burns of the Eyes.—Burns of the lids are treated by irrigating with boric acid, then drying and applying a bland ointment such as boric acid. When the pain is severe a wet dressing of bicarbonate of soda solution is soothing and lessens the pain.

Burns of the conjunctiva and cornea are sometimes caused by boiling water, steam, lime, mortar, acids, powder, or molten metal.

The *treatment* consists in the complete removal of the irritating substance as soon as possible. Solids are removed as foreign bodies. The conjunctival sac is then irrigated with a solution which will neutralize the substance or render it insoluble. Boric acid solution is used to remove lime, mortar and other caustic alkalies. A weak solution of bicarbonate of soda may be used to remove acids. Cold compresses are usually ordered to relieve inflammation and prevent swelling and pain. Atropin is used as a sedative and to dilate the pupil. A bandage is sometimes used to protect the eye.

Care of Artificial or Glass Eyes.—An artificial eye worn by a patient should be washed frequently and should be removed every night. Patients frequently do this for themselves but it is important for a nurse to know the proper method of procedure. The following instructions are taken from the text prepared by the Manhattan Eye, Ear and Throat Hospital.

To Insert the Eye:—"Place the left hand flat upon the forehead, and with the tips of the two middle fingers raise the upper eyelids. With the right hand push the edge of the artificial eye beneath the upper lid, which may now be released by the fingers and allowed to drop upon the eye. The latter must then be supported by the fingers of the left hand, while with the right hand the lower lid is drawn forward and made to secure the lower edge of the shell, thus holding it firmly in place."

To Remove the Eye:—"Draw down the lower lid with the middle finger of the left hand. Then, with the right hand, place the end of a small blunt instrument under the edge of the artificial eye, which is made to slip forward over the lower lid, when it will readily drop out. This maneuver must be carried out with care, as the eye can very easily be destroyed by dropping on a hard surface." The eye should be put away carefully for safe keeping and to avoid breakage or roughening of its surface. The eye socket should be watched for signs of irritation or inflammation. In some cases mucus and tears are apt to collect between the stump and the shell. It is said that after a year the surface and edges of the eye become roughened so that it must be replaced by a new one to avoid irritation.

TREATMENTS TO THE EAR

The importance of the function of the ear and its intimate relation to the mastoid cells, dura mater, lateral sinus, and the brain all emphasize the dangers in diseases of the ear and the importance of knowledge, skill, and expert care in the treatments and nursing care.

The duties of a nurse may be to assist the surgeon with examinations, to apply remedies such as ointments, dressings, and hot or cold applications to the external ear; to irrigate the auditory canal in diseases of the canal or middle ear, and to assist the surgeon with minor operations such as a myringotomy, the incision of furuncles, and the removal of wax or foreign bodies.

In order to recognize the symptoms of complications and to perform the above duties intelligently, one must have constantly in mind the anatomy and physiology of the ear, the disease from which the patient is suffering, the possible complications, the dangers and discomforts in the treatment, and how to secure the best results with the least discomfort or danger to the patient.

To Assist the Surgeon with an Aural Examination.—As in an examination of the eyes, the chief duties of the nurse are to place the patient and the light in the proper position, and provide the necessary articles.

The *articles* required for the examination will be a head mirror, ear specula of various sizes, an attic probe (a fine silver probe, tapering to the size of a pin, with a small rounded end, which can be bent in any direction), curettes, a pair of ear forceps, an applicator and sterile absorbent cotton, alcohol and hydrogen peroxid. A tongue depressor and a nasal speculum will also be needed to detect the presence of adenoids or enlarged tonsils which are frequently the cause of diseases of the ear. Ear specula should always be warmed before use, otherwise they may cause dizziness and earache.

The Position of the Patient.—The *light* and its position are most important. No treatment or examination should be attempted without a good light. The patient may be allowed to sit up on a chair or the examination may be made with the patient lying down. In either case, he should be turned, or his head should be turned so that the ear to be examined is toward the examiner and away from the light. The position of the patient should be comfortable, not strained, neither should it require any effort or strain on the part of the examiner.

Daylight from a northern exposure gives the best light, direct sunlight being too dazzling. Artificial light may be used. It should be placed or held behind the patient's head, on a level with the ear, on the side corresponding to the surgeon's mirror, so that the light will strike the mirror at an angle of about forty-five degrees, and be reflected into the external auditory canal.

A towel is placed across the patient's shoulders and the head is also draped with a folded towel. The surgeon places his hand on the head to steady it in the desired position; the necessary instruments, etc., are placed conveniently for the surgeon, the nurse assisting him as required.

The nurse should stand behind the patient ready to support his head, which is usually inclined slightly away from the examiner. It is necessary that the head should be kept perfectly still, to allow a thorough examination, and also to prevent injury with the speculum by a sudden jerk of the head. The ear may be extremely sensitive, the patient may be very nervous from prolonged pain so that the insertion of the speculum may cause considerable discomfort.

If the patient to be examined is a child he may be held as shown in Figure 151.

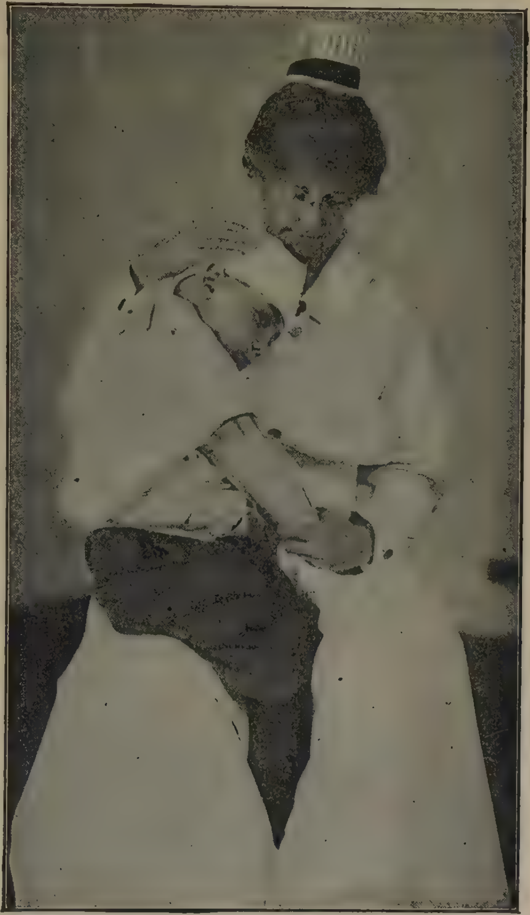

Fig. 151.—Showing Method of Holding a Child for an Examination of the Ears.

The Application of Dressings.—Ointments such as zinc oxid, Lassar's paste, or ammoniated mercurial ointment, are used chiefly in the relief of eczema. Eczema may involve the auditory canal, the auricle, the face and the scalp. When the scalp is involved the part should be shaved. All crusts and scales are softened and removed by the application of olive oil before applying the ointment. Pledgets of cotton saturated with olive oil are used in the auditory canal or sometimes hydrogen peroxid is used to soften and dissolve the crusts and scales. In the case of children a tight-fitting cap of light material should be worn in order to avoid picking and scratching.

Moist dressings of cooling and soothing lotions such as lead and opium, aluminum acetate, or plumbi acetate are used in the treatment of dermatitis, perichondritis, and other inflammatory diseases, and following minor operations such as a myringotomy (incision in the drum membrane), or incision of a furuncle in the aural canal.

Irrigation of the Ear.—*Purpose of the Treatment.*—This treatment is necessary in inflammatory diseases of the middle ear or auditory canal for the purpose of removing discharges and relieving the inflammation and congestion.

Anatomical Factors to be Considered When Irrigating the Ear.—The auditory canal in the adult is about 1½ inches in length, its outer third being cartilaginous, the inner two-thirds of bone. It is separated from the middle ear chamber by the tympanic or drum membrane. In the infant, the canal is mostly cartilaginous and nearly straight, but, because the drum membrane at the end of the canal is oblique, the floor of the canal is in contact with it. In irrigating, to draw them apart, so that the fluid will reach all parts, the auricle is drawn gently downward and backward. In the adult, the canal is curved, resembling the letter S. This is because "in passing from without inward the outer portion slopes upward, the inner part downward so that the center of the canal is the highest point of an upward convexity. Furthermore the outer part inclines sharply forward and then bends backward, while the bony or inner portion inclines gently forward again. Hence in the adult, to straighten the canal"—the auricle "is pulled upward to straighten the upward curve and backward to straighten the anteroposterior curves." (Woolsey.)

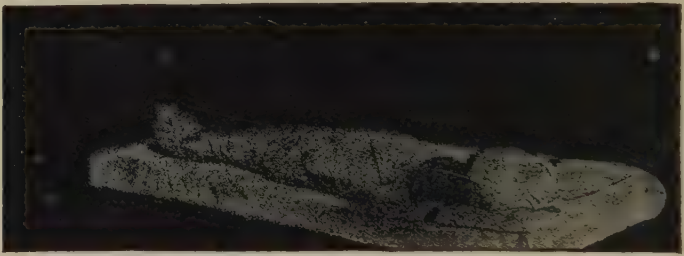

Fig. 152.—Showing Method of Restraining a Child for an Examination or Dressing. (From "Nursing in Diseases of the Eye, Nose and Throat," by the Manhattan Eye, Ear and Throat Hospital. W. B. Saunders Co., Publishers.)

The Method of Procedure.—The *articles* required will be the solution ordered, the irrigator, a towel to cover the shoulder, an applicator, sterile cotton, and a basin for the return. The irrigator may be a soft rubber bulb syringe or an irrigating can, tubing and tip. The rubber bulb or irrigating tip used for irrigating must be sterile before use, and cleansed and sterilized after use.

The treatment must not be attempted without a good light.

The *solutions* used are cleansing and antiseptic solutions such as boric acid, normal salt solution, bichlorid of mercury 1:5000 to 1:10,000 or chlorozene 1:5000, etc. Bichlorid of mercury is usually contraindicated in acute cases, as it tends to excoriate the skin, cause sloughing, and prevent healing.

The *temperature* of the solution should be such as to give a sensation of comfort. It may vary from 106° to 112°. Never use a solution which feels cool to the patient as, in a sensitive ear, this may cause a severe earache which may last for hours, giving the patient no rest.

During the irrigation, the *flow* should be gentle, steady and continuous. There should be no air in the bulb and no air bubbles forced into the canal. These produce loud sounds like explosions and cause great discomfort to the patient. The stream should be gentle, with very little force, to avoid the danger of injuring the drum and, also, to avoid the danger of causing dizziness and faintness in the patient. The flow of hot solution should be continuous to avoid sudden chilling during the intervals, due to the evaporation of moisture in the ear in contact with the air. This causes great discomfort, a sensation of coldness, dizziness and, sometimes, nausea. When the small rubber bulb is used as the irrigator, it is wise to use two so that one will be filling while the other is in use. The tip of the syringe should be placed at the opening of the canal or barely within so as not to block the passage of the return flow. The basin for the return is held just below the auricle against the neck. Usually the patient can hold the basin, but the nurse should see that it is not tilted, allowing an overflow, and that the patient's fingers are not contaminated. The discharge may contain very virulent organisms. When straightening the canal, do not grasp and pull on the tip but take firm but gentle hold of the cartilaginous portion of the auricle.

When the canal is thoroughly cleansed, it should be carefully dried with sterile cotton. When using an applicator it is important that it should be properly and securely protected with cotton both to avoid injury to the delicate tissues and to prevent the cotton from slipping and being left in the ear. The treatments may be given every two or every four hours. A piece of sterile absorbent cotton should be left in the ear between the treatments, to prevent the discharge from running over the auricle and excoriating the skin. The cotton should be changed frequently, or when soiled. When soiled, it no longer serves its purpose and may act as a plug. With children it is wise to have them wear a tight, but thin cap, to prevent them from pulling out the cotton and from contaminating their fingers.

In charting, note the amount and character of the discharge. Note, also, whether the treatment caused nausea, dizziness or any other discomfort.

Myringotomy.—A myringotomy is an incision into the drum for the purpose of providing a channel for the drainage of fluid or pus from the middle ear. It is performed when the drum is red and bulging as this indicates the accumulation and pressure of fluid resulting from otitis media.

This minor operation is performed by the surgeon. The duties of the nurse are to prepare the patient and the articles required.

Preparation of the Patient.—The patient should be in bed, lying on his side, close to the side of the bed, and with the ear to be operated upon uppermost. A general anesthetic is nearly always given because the ear is so very sensitive and painful and even the slightest movement might result in a very serious accident. Nitrous oxid gas is commonly used. Frequently no anesthetic is given to very young babies. They may be wrapped firmly in a sheet and the head may be held quite still by the nurse. When the surgeon is ready to begin, sterile towels should be placed across the shoulder and around the head, covering the hair. In some hospitals a square made of several thicknesses of gauze with an opening or slit large enough to expose the ear is used for draping. This covers the neck, side of the face and head and so renders the area around the ear sterile. These squares may be used when examining the ears; when used for this purpose they are not sterile.

The *articles* required will be a myringotomy knife (myringotome), ear specula, ear forceps, an applicator, sterile cotton, sterile cotton tooth-picks, hydrogen peroxid and alcohol. Glass slides will be required if smears are to be made from the discharge. All the instruments used should be sterile. The myringotomy knife is sterilized by immersion in 70 per cent. alcohol. It must never be allowed to come in contact with a hard surface and should not be wrapped in cotton as this dulls the blade. The examiner may require sterile rubber gloves. Some surgeons irrigate the canal directly after the incision is made for the purpose of washing out any blood-clots which, if allowed to remain, might block the incision. Some surgeons apply a moist dressing after the operation to absorb the discharge. When these are required the necessary things should be in readiness. A good light is absolutely essential. It should be placed so that it will be reflected by the doctor's head mirror into the patient's ear.

After a myringotomy the canal is usually irrigated every two or three hours according to the amount of the discharge. Sterile cotton is kept in the canal between treatments.

Incision of Furuncles in the Aural Canal.—The preparation of the patient is much the same as for a myringotomy. A general anesthetic is usually given but sometimes the patient is allowed to sit up in a chair and the canal is anesthetized with cocain.

The articles and instruments required are also much the same. These consist of sterile towels for draping; sterile cotton and antiseptic solutions such as alcohol, hydrogen peroxid and carbolic acid for cleansing the canal; sterile instruments such as ear specula, furuncle knife, ear forceps, curettes, scissors, applicator, probe, director, and basin for soiled instruments. Sometimes the canal is irrigated after the furuncle is incised and sometimes it is packed with plain gauze packing saturated with an antiseptic solution such as carbolic acid 1 per cent. to prevent further infection and formation of furuncles. Carbolic also acts as a local anesthetic. The after-care varies. Usually a large moist dressing is applied. The solution used may be cooling and soothing, such as aluminum acetate, or it may be an antiseptic solution such as 1 per cent. carbolic acid. The antiseptic dressing must be kept moist and should be changed frequently to prevent the formation of furuncles. The soothing dressing is usually followed by irrigations of the canal with an antiseptic solution, such as boric acid or bichlorid of mercury 1:10,000, every two hours. Sterile cotton is kept in the canal between treatments.

In the treatments of furunculosis, attention to the general health is very important. The condition is more apt to recur in anemic or diabetic patients. Tonics, fresh air, and careful regulation of the diet are, therefore, essential. The injection of vaccines, either autogenous or stock vaccines (staphylococcus) sometimes builds up the patient's resistance and prevents a recurrence of the infection.

Removal of Cerumen (Ear Wax) and Epithelial Plugs (Dandruff).—Ear wax or scales of epithelium may collect in the auditory canal and completely obstruct the passage or may become caked against the drum membrane. The result may be deafness, a sense of fullness, dizziness, sometimes pain, and a reflex cough. The reflex cough is due to an irritation of Arnold's nerve, a branch of the pneumogastric nerve which supplies the lungs. Epileptic attacks have been caused by the presence of hardened wax in the auditory canal. Irritation, inflammation and ulceration may occur if the hardened wax is not removed. Cerumen is more apt to collect in aged persons because the external meatus becomes flattened.

The treatment consists in softening the mass and removing it by syringing. Sometimes instruments are necessary to remove it, but this should be attempted only by an expert person. A nurse should never attempt to do so. Frequently, before syringing, it is necessary to soften the hardened cerumen or epithelial plug by the instillation of drops. A solution commonly used for this purpose consists of bicarbonate of soda gr. xxv; glycerine ʒ i and aqua, ℥ i. When the wax is very hard the instillations may have to be repeated several times a day for several days before it can be removed by syringing. Frequently it is only necessary to allow the drops to remain for about fifteen minutes before syringing. The patient should be allowed to lie down in the interval. Instillations of warm hydrogen peroxid are also commonly used and allowed to remain in the ear for five or ten minutes before syringing.

The *solution* used for irrigating is usually bicarbonate of soda ʒ i to a pint of warm water.

The syringe used may be the small rubber aural syringe, but is usually the large metal Pomeroy or the Neumann ear syringe. These metal syringes are heavy, difficult to handle without injury to the ear and to manipulate so as to secure a steady, continuous stream with little force. Considerable practice is necessary before these syringes can be used with safety or skill. Therefore, in some hospitals where it is impossible for all the pupil nurses to have sufficient practice they are not allowed to use these metal syringes.

A good light is essential for this procedure. The surgeon must direct the stream of solution between the wax and the canal at different points so as to separate it and force it outward.

After removal of the wax or epithelial plug, the canal is carefully dried and the ear is usually inflated because the drum is often found retracted. Absorbent cotton is then placed in the meatus, and allowed to remain for the rest of the day.

The metal syringe is easily cleansed and sterilized as it can be taken apart.

Removal of Foreign Bodies from the Auditory Canal.—A surgeon will always carefully inspect the canal before attempting to remove a foreign body. It may usually be removed by persistent syringing with warm water. No other method should ever be attempted by a nurse. Instruments are sometimes necessary but should be used only by a skilled otologist. In the hands of an unskilled person an instrument may push the foreign body farther into the canal or may cause such irritation, inflammation and swelling, that an operation under a general anesthetic is necessary to remove it. (An incision behind the ear into the canal is made.) Gravity, that is, inclining the patient's head toward the affected side, is helpful and in children, in whom the canal is straight, rotation with the finger in front of the ear is sometimes helpful in causing a round, smooth body to work its way outward.

When syringing the ear, the patient's head should be inclined toward the affected side. The auricle should be held upward and backward and the stream directed between the foreign body and the canal. If the foreign body is a *seed* and the water does not remove it, but causes it to swell, the canal may be syringed with alcohol. Alcohol absorbs the water, prevents swelling, and may cause the seed to shrink. The instillation of oil or glycerine before syringing aids in the removal of seeds. When the foreign body is an insect, syringing with water stimulates it and causes great discomfort to the patient. The instillation of oil or a drop or two of chloroform kills insects, after which they may easily be removed by syringing. The ear should be carefully dried afterward and absorbent cotton left in the meatus to prevent chilling and earache.

Symptoms to be Watched for when Nursing Patients with Otitis Media.—The danger of serious complications in purulent otitis media should always be remembered and the symptoms constantly watched for. Such symptoms as the following should be reported to the surgeon immediately:—a chill and sudden rise in temperature, dizziness, nausea, vomiting, nystagmus, intense headache, pain or tenderness, stiffness of the neck or retraction of the head, delirium, drowsiness, stupor, or coma. These may indicate acute mastoiditis, inflammation of the internal ear, meningitis, perisinus abscess, epidural or brain abscess, and septicemia or pyemia.

TREATMENTS TO THE NOSE AND THROAT

The duties of a nurse may be to assist the doctor with examinations, to apply remedies in the form of sprays and inhalations, to give nasal and throat irrigations and to assist the doctor with an intubation or a tracheotomy.

The intimate relation of the nose to the eyes, ears, throat, the various sinuses of the head and the brain; the delicacy and vascularity of its mucous lining and the spongy character of its bony structure, the frequency with which it forms a lodging place and portal of entrance for virulent, pathogenic germs and the relation of the nose and throat to the lung, a vital organ, all emphasize the dangers in diseases of the upper respiratory tract and the need for knowledge, skill and expert care in the treatments and nursing care.

To carry out the above duties intelligently, and to secure the best results with the least discomfort and danger to the patient, one must have constantly in mind the anatomy and physiology of the part, the disease from which the patient is suffering, the possible complications, the dangers and discomforts in the treatment, and how best to avoid them and secure the desired results.

To Assist the Doctor with an Examination of the Nose and Throat.—For these examinations, the patient should be seated on a chair, preferably a high-backed chair, so that his head may rest against the back of the chair. The examiner sits facing the patient on an adjustable stool arranged so that his head will be on a level or a little above that of the patient. A reflected light is always used, that is, a light which is reflected from a head mirror, worn by the doctor, into the part examined. The doctor wears the head mirror on the left side so that the light must be on the right side of the patient on a level with his ear and a little behind the transverse axis uniting the ears. The examination may be made in daylight but artificial light is usually used—it must be adjustable to the height of the patient. A towel covers the patient's shoulders.

When the patient to be examined is a child he may be held as shown in Figure 153.

The instruments required for the examination of the anterior part of the nose will be nasal specula, nasal forceps, a probe, an applicator and sterile absorbent cotton. As the nasal mucous membrane is very sensitive and sometimes so swollen as to make the examination difficult, cocain hydrochlorate is frequently sprayed from a hand atomizer or painted over the part to anesthetize the part and reduce the swelling.

For an examination of the nasopharynx and posterior structures of the nose, in addition will be required a tongue depressor and a small throat mirror which is placed at the back of the mouth to reflect the light into the nasopharynx. All mirrors used for examination should be warmed. An alcohol lamp will be required so that the mirror may be warmed in the flame.

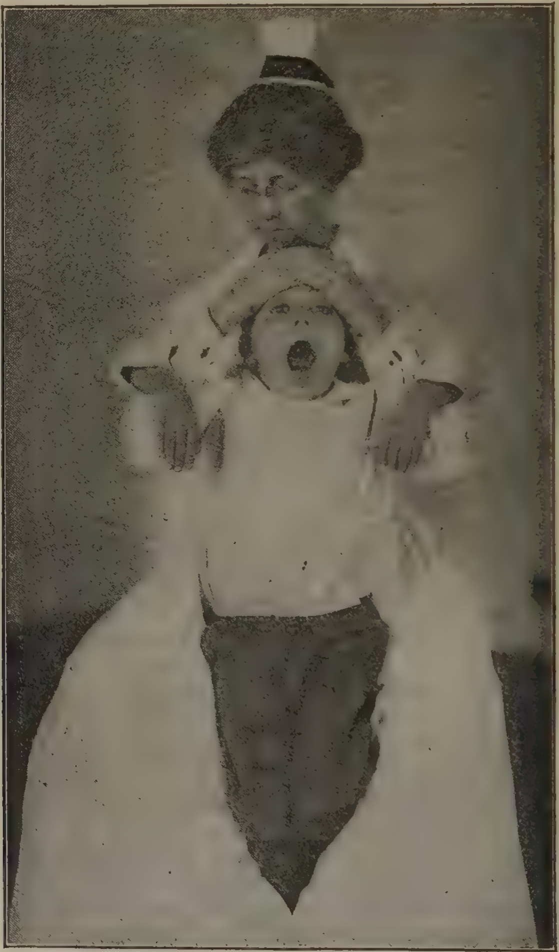

Fig. 153.—Showing Method of Restraining a Child for an Examination of the Throat.

For an examination of the larynx a laryngeal mirror and a napkin or several thicknesses of folded gauze with which the doctor grasps and pulls forward the tongue will be needed.

The instruments used for examinations should be sterilized by boiling. After use and before using for another patient they should be resterilized, preferably by boiling or by immersion in carbolic acid solution 1:20. Before using the instrument again this strong solution should be rinsed off with carbolic solution 1:100 to avoid burning the patient. These solutions should be changed frequently. Laryngeal mirrors are soon destroyed by boiling so are sterilized by immersion in a carbolic solution.

In the examination of patients with a primary or secondary syphilitic lesion in the nose or throat, the doctor usually protects his hands with gloves. There should be a separate set of instruments for these patients, if possible, and in any case, after use they should be kept separate and immediately sterilized by boiling or placed in carbolic 1:20 solution and boiled later. If a number of patients are being examined these are left until the last.

In the examination of patients with tuberculous lesions the same precautions as to the use of the instruments and the order of examination should be observed. If these precautions are not strictly observed these serious and highly contagious diseases may be transferred to other patients.

Sprays are used in acute or chronic inflammation and in ulcerations of the lining of the nose or throat. They may be applied to the mucous lining of the nose or throat by means of a hand atomizer. The solution is forced out through the perforated tip by increased pressure of air made by squeezing the rubber bulb attached. An instrument should be used which gives a generous stream as a very fine spray is apt to injure the tissues. A forceful spray is also very injurious to the tissues.

The *solutions* used vary according to the condition and the results desired. They should always be ordered by the doctor. All solutions used should be warmed to a temperature of 100° F. If the solution causes pain it is too strong and this fact should be reported to the doctor, who will probably dilute it.

Method of Application.—A spray is frequently administered by the patient himself but the nurse should see that it is properly applied. When applied to the nose the tip of the nostril should be raised and the tip of the atomizer placed just within the nostril. If introduced too far it may injure the septum. Very little force should be used. Greater force may be used when applied to the throat. If possible there should be separate tips for watery and oily sprays. After using a watery spray, patients should not be allowed to go out immediately into the cold as they are very apt to catch more cold and increase the inflammation.

Gargles are used in the same conditions of the throat in which sprays are used. The solutions used may be cleansing or antiseptic, etc., and are used either hot or cold. The patient must be cautioned against either swallowing or inhaling the solution.

The rigid control of the throat and breathing necessary in gargling is very difficult to the already sensitive throat so the solution may fail to reach all parts of the inflamed mucous lining. For this reason some doctors prefer sprays which may be directed to the diseased part.

Throat Irrigation.—A throat irrigation is used for inflammatory diseases of the throat or tonsils, such as pharyngitis, tonsillitis, scarlet fever, and diphtheria. The irrigation is a direct application of moist heat to the mucous lining of the throat.

Purposes and Effects of the Irrigation.—This treatment is given for the following reasons:—(1) To soften mucus and to remove accumulated secretions and discharges; (2) to stimulate the circulation and cause the absorption of inflammatory products; (3) to relieve congestion, swelling and pain and to promote healing; (4) to stimulate the inflammatory process (suppuration) and "bring to a head" as in quinsy so that the abscess may be incised and the pus removed.

The *solutions* used are varied and may be plain hot water, normal saline or water with bicarbonate of soda ʒ i to a quart.

The *temperature* is ordered (may be 100° to 120° F.) but is usually as hot as the tissues will stand but should not be more than 118° to 120° F. The sensations of the patient are not always a safe guide because when in great pain or discomfort a very hot solution may give great temporary relief and at the same time burn the tissues. The continued use of moist heat also softens and relaxes the tissues and paralyzes the blood vessels, lowering their resistance and interfering with their subsequent healing.

The results of this treatment depend upon the temperature of the solution and the way in which it is given. To obtain the desired results a continuous stream must reach the parts affected without causing the patient to gag, thus forcing him to swallow or aspirate the solution.

A patient frequently prefers to give this treatment himself and, when up and walking around, the doctor may permit him to do so. The nurse then prepares the treatment, gives any assistance or instructions necessary and sees that the treatment is satisfactorily given.

Method of Procedure.—The articles required will be an irrigating pole, irrigating can, tubing with clamp, a sterile irrigating tip, the solution, a large pail or basin for the return, protection for the chest and shoulder of the patient and, when given in bed, for the bed.

When the patient is in bed there are two methods of procedure sometimes used—some doctors and patients prefer one, some the other. In one method, the patient lies across the bed, in a comfortable position, so that his head hangs over a pail which rests on the floor and the patient himself directs the stream against the part affected. The nurse adjusts the apparatus, regulates the flow of the stream and may support the patient's head. In this method the patient can usually control the position of his tongue better so that it does not obstruct the flow and the stream can be directed farther back to all the diseased part without causing gagging or coughing or the danger of swallowing it.

In the second method the patient sits up in bed, at the side, supported with pillows and with his head bending forward over a basin. The nurse manipulates the tubing and tip and directs the stream upon the parts affected. It is absolutely essential, therefore, that she should see what she is doing.

Before beginning the irrigation she should carefully examine the throat. To do this, the tongue must be depressed with a tongue depressor as it obstructs the view and very few patients can keep the tongue down for a sufficient time. A wooden tongue depressor may be used and destroyed after use. If the tongue depressor is not properly used it will so displace the tongue as to further obstruct the view and the stream, making the treatment useless. It must be remembered that the space for the tongue is limited. Placing the tongue depressor too far forward on the tongue depresses the anterior part, causing the posterior part to rise, thus obstructing the view. Placing it too far back pushes the tongue backward and this produces gagging which, once excited, is repeated with further attempts to depress the tongue as the pharynx is so very sensitive.

This is a procedure a nurse may frequently have occasion to use, the success of a treatment depends upon it, and it is important that it should be correctly and skillfully done. Dr. Coakley gives the following rules to be observed:—The mouth should be opened nearly to the full extent. The patient should be told to allow the tongue to rest within the mouth. (Many patients as soon as they open their mouths protrude the tongue.) Attempts at depression with the tongue protruded result in injury to the tongue and spasm of the organ, with insufficient depression. If one carefully observes the tongue while lying quietly within the opened mouth, he will see that it is arched from before backward. Pass the depressor into the mouth carefully, avoiding touching any of the tissues, particularly the upper surface of the tongue, until the tip of the tongue depressor passes about one-eighth of an inch beyond the highest point in the arch of the tongue, then gradually lower the depressor and make gentle, steady pressure upon the organ. Do not slide the tongue depressor over the surface of the tongue; that of itself is often sufficient irritation to cause reflex gagging. Keep the tongue depressor in the median line. Pressure to one side or the other crowds the tongue so much to the opposite side as often to cause gagging. Avoid using too great pressure, for in so doing there is insufficient space along the floor of the mouth for the depressed tongue, and it is again forced backward, with the inevitable gag.

With the tongue depressor in position and the tissues in view the nurse directs the stream. The patient's head should be turned toward the light and bent sufficiently forward to allow the return to flow into the basin and to prevent the possibility of the discharge being swallowed—gagging will surely cause this, so stop if the patient gags, coughs or chokes.

When satisfied with the results discontinue the treatment. Do not continue long enough to exhaust or tire the patient. Usually one quart of solution is used.

Whatever method is used, the bed and patient should be protected.

This treatment usually gives great comfort and relief and when the patient objects it is frequently because it is not properly given. The treatment and its results are charted.

Inhalations.—Inhalations, or the administration of medications by inhaling, may be dry or moist.

Dry inhalations are frequently used in the form of "smelling salts," in which the medications are contained in a tightly corked bottle, the cork being removed only when in use. They contain drugs which increase the secretions (expectorants), such as ammonium chlorid, ammonium carbonate, tincture of benzoin comp. (which is also antiseptic), and carbolic acid, which is an antiseptic and local anesthetic.

Moist or steam inhalations may be plain or medicated.

They are used (1) to relieve inflammation of the mucous membrane in acute colds and in sinusitis, (2) to relieve inflammation, congestion and edema of the larynx, (3) to loosen the secretions and relieve coughing in tuberculous laryngitis, and in membranous laryngitis, (4) to soften thick, tenacious mucus in chronic laryngitis, (5) to warm and moisten the air following operations on the larynx such as a tracheotomy when the air passes directly to the larynx through the tube instead of through the nose and, (6) in acute bronchitis and whooping-cough the steam allays the irritation by moistening the air. It checks coughing and aids the action of the drugs. The inspired air is carried to and benefits the farthest bronchioles and vesicles of the lungs.

Volatile substances are frequently added to the water, which is kept at a temperature of 150° F., the steam from which is directed toward the nose and mouth of the patient so that the moistened air and drug may be inhaled and come in contact with the inflamed tissue. Antiseptics such as tincture of benzoin ℥ i to a pint, oil of turpentine, menthol, creosote, oil of eucalyptol and other drugs are used. Oil of turpentine and tincture of benzoin also loosen and increase the secretions and relieve coughing.

Method of Procedure.—Various inhalers are used. The medicated solution may be poured into a narrow-necked pitcher, over the mouth of which should be placed a cone of cardboard or oiled paper which directs the steam toward the mouth of the patient. An ordinary tea-kettle may be used in the same way. The Maw's inhaler, made of earthenware, is frequently used as it retains the heat for a considerable time. The "croup kettle"—a tin kettle with a long spout to which the cone may be attached —is commonly used in the hospital. When available, an electric stove is the best and safest means of keeping the solution hot.

When it is desirable to have the patient breathe warm, moist air continuously or for a prolonged period without the effort, strain and discomfort of keeping the face turned constantly toward the inhaler (even during sleep) which is very exhausting, or if in the case of a child with croup a "croup tent" should be arranged around and over the head of the bed. The outer covering of the tent may be of linen but the inner lining must be of blanket in order to absorb the moisture and to prevent the condensed steam from falling on the patient or bed. The head of the bed must be securely enclosed so that the steam will not escape. There should be ample ventilation, however, and the tent "should not be kept so warm that both patient and nurse get a steam bath." There must be no drafts. The kettle should be on a table or chair, the spout extending into the tent at the side or back but it must not extend far enough for the patient to touch it, or over the patient in order to avoid the condensed steam falling on and scalding him. He must be watched closely.

In whatever method used, great care must be taken that the steam is not too hot and that it does not scald the patient. Great care also must be taken to protect the patient from drafts and he must not be allowed to go out of doors for several hours as the relaxation of the mucous membrane and blood vessels makes a patient very susceptible to the cold and predisposes to a more severe and prolonged attack of inflammation and congestion.

Nasal irrigations are used in the treatment of rhinitis and sinusitis. They should be given with extreme care by an experienced person and only when ordered by a doctor.

The *purpose* of the treatment is to soften and remove mucus, dried secretions, crusts, pus and other discharges and to relieve congestion, swelling and pain.

The *solutions* ordered may be plain hot water, normal saline or bicarbonate of soda solution. When the odor from crusts is very foul, as in atrophic rhinitis, a solution of potassium permanganate may be ordered as a deodorant.

The *temperature* varies from 105° to 110°—the hotter the better as the heat draws out the pus.

Method of Procedure.—The danger of forcing the discharge and spreading the infection to the throat and up the Eustachian tube to the middle ear, causing otitis media and thus predisposing to other serious complications which may occur, should be kept constantly in mind. The aim is to cause a copious, gentle and uniform stream of solution to pass up one nostril, back into the nasopharynx, around the septum, and out of the other nostril.

Preparation of the Patient.—The treatment may be given, if necessary, with the patient in bed lying on his side close to the edge of the bed. It is best given with the patient sitting up in a chair bending over a sink or basin. The head should be well flexed on the chest. A towel or sheet may be used to drape the patient.

The *articles* used vary with the method. The irrigation may be given with a Douglass syringe or with a douche bag or can, rubber tubing and nasal irrigating tip, and basin for the return.

During the procedure the patient must sit with his head bent forward and his mouth open. He should be instructed to breathe through his mouth. He should also be instructed not to swallow as this depresses the palate muscles and opens the Eustachian tubes.

The irrigating tip or nozzle should be inserted in the nostril just tightly enough to prevent the return of fluid from that nostril. The irrigator should be held just high enough (usually not more than 2 or three inches above the level of the patient's nose) to cause a gentle, steady stream of fluid to flow out the other nostril. Force or pressure should never be used as it would probably force some of the discharge up the Eustachian tubes. The flow should be checked if the patient coughs or chokes as this opens the Eustachian tubes and indicates that the solution is not returning properly, due to some obstruction. Some authorities state that the stream should be first directed up the unaffected side. This washes out the discharge from the affected side without the danger of forcing it up the Eustachian tube or spreading the infection to the unaffected side. Other authorities advise syringing through the obstructed side. In this method the unobstructed nostril allows free passage for the exudate.

A sufficient amount of solution is used to thoroughly cleanse the nostrils. Patients should be warned not to blow excess fluid from the nose for several minutes after the procedure as this act may force discharges into the Eustachian tubes and middle ear. They should not be allowed to go out in the cold for at least half an hour as the hot irrigation and increased blood supply in the mucous lining predispose to colds.

In charting the procedure the amount of solution used, the character of the return and any symptoms of middle ear disturbance such as a sensation of water in the ears, should be noted.

An **intubation** consists of the introduction of a hard rubber or gold-plated metal tube into the glottis for the purpose of keeping the normal respiratory channel sufficiently open to allow the patient to breathe until such times as the obstruction to breathing may be removed.

It is *indicated* whenever an obstruction to breathing causes marked dyspnea, producing cyanosis and exhaustion of the patient in the effort to breathe. It is frequently required in diphtheria, and in inflammation and edema of the glottis from any cause.

The "intubation set" or articles required consists of a mouth gag, an intubator or introducer, an extubator for the removal of the tube and a graded set of hard rubber tubes, corresponding to the age of the patient and size of the larynx, devised by Dr. Joseph O'Dwyer. The tubes are threaded with silk thread and are each attached to an obturator.

The Procedure.—The *position* of the patient is extremely important in order to enable the doctor to insert the tube—the nurse is responsible for the position and the success of the treatment largely depends upon it. An *adult* may be placed horizontally on the bed or table with the head held perfectly straight. A *child* should be wrapped closely and confined in a sheet and should be held upright by the nurse with the child's feet held securely between her knees and with the back of its head resting upon her shoulder. Another assistant should hold the child's head up and backward as far as possible with the chin in a straight line with the trachea. This assistant also holds the mouth gag in place. The doctor sits directly opposite the patient.

A good light is essential. The doctor may wear a head mirror from which the light is reflected into the child's throat. Otherwise the child should be held so that the light from a window or artificial light will shine directly in the throat.

When the tube is first inserted there will be a good deal of mucus secreted—hold the child's head to one side to allow this to escape. If the tube is properly in the larynx one or two coughs will be given. The breathing which before was croupy becomes quiet. The color improves, cyanosis disappears and the child, almost worn out with his struggles, usually falls asleep. If the tube is in the esophagus, instead of the larynx, coughing will not occur, the color and breathing will not improve and the string, attached to the tube and left hanging from the mouth, will be seen to gradually recede due to the peristaltic action of the muscles of the esophagus. The silk should be left hanging and observed carefully for about 10 minutes. It is then either removed or tied around the ear and fastened to the cheek with adhesive. One objection to the silk is that it is possible for a child to reach it and pull it out. When the silk thread is removed from the tube after it is inserted into the larynx, there is said to be no danger of the tube entering the trachea because the whole tendency is to cough the tube up and out. It may, however, enter the esophagus.

The insertion of the tube should take only about 2 or 3 seconds and should not last more than 15 seconds as during the introduction the breathing is obstructed. The child should be constantly and very carefully watched.

The best method of *feeding* the child is by *nasal gavage.* Precaution must be taken to see that the catheter is in the esophagus. Great care must be taken to avoid liquid entering the tube as this would strangle and produce coughing. Coughing may expel the tube and the child may die of asphyxia. When nasal feeding is not used hold the child's head much lower than the body and feed liquids with a spoon. *Rectal feeding* will have to be resorted to if there is difficulty of feeding without the liquid entering the tube and causing coughing.

The tube is usually left in for from 2 to 7 days; in diphtheria, usually about 5 days, depending upon the rapidity with which the membrane is absorbed.

The position of the patient for the removal of the tube is the same as for the introduction. After its removal the physician usually waits and watches the patient, for at least one hour, for swelling of the parts and renewed difficulty in breathing.

A **tracheotomy** consists of a vertical incision made into the trachea and the insertion of a double tracheotomy tube through which the patient breathes.

It is indicated when it is difficult or impossible for the patient to breathe through the larynx due to some obstruction to respiration which cannot be overcome by an intubation or other means and the patient is in danger of asphyxiation or exhaustion from his efforts to breathe.

1. In acute inflammation with urgent dyspnea as in laryngeal diphtheria or croup when not relieved by an intubation.
2. In edema of the glottis which causes dyspnea, hoarseness and a croupy cough. The submucous tissue above the glottis is very loose and may swell very rapidly in acute laryngitis, etc., obstructing the glottis and endangering the life of the patient from asphyxiation.
3. In Bright's disease with general edema, including edema of the glottis.
4. In tuberculosis of the larynx with inflammation and edema.
5. With malignant growths such as carcinoma of the esophagus. The cartilaginous rings of the trachea are completed at the back, where it is in contact with the esophagus, by soft muscular tissue so that carcinoma of the esophagus may cause serious difficulty in breathing by pressing on the soft portion of the tracheal wall.
6. With benign tumors.
7. In ulceration and stenosis of the larynx due to syphilis and other causes.
8. In obstruction due to foreign bodies in the larynx or throat. Also, for the purpose of removal, when a foreign body is in the bronchi.
9. In paralysis of the muscles of the vocal cords.

The incision into the trachea may be made above or below the isthmus of the thyroid gland. The trachea is partly in the throat and partly in the thorax. The isthmus of the thyroid extends across it at a level with the second or third tracheal ring. When the incision is made *above* the isthmus, it is called a *high tracheotomy*, when made *below*, a *low tracheotomy*.

A *high tracheotomy* is always performed where possible in preference to a low tracheotomy for the following reasons:—

As the trachea descends it passes somewhat backward so that the lower portion is deeper and, therefore, much more difficult to reach. The upper part is quite superficial, therefore more accessible. In addition, the dangers involved in a low tracheotomy are much greater because of the large arteries and veins which either cross it above the sternum or are in close relation to it. As these vessels are usually congested when a tracheotomy is indicated, the danger of injury with a fatal hemorrhage may be very great. The danger from bronchopneumonia, which is apt to follow a tracheotomy, is also greater. However, a *low tracheotomy* is sometimes necessary in order to relieve an obstruction low in the trachea or to remove foreign bodies from the bronchi which, if not removed, may cause a fatal result.

The very greatest care and vigilance, therefore, must be observed both during the operation and in the after-care of the patient following a tracheotomy, whether high or low, but particularly when a low incision has been made.

The Procedure.—The trachea may have to be opened in an emergency when the patient is already greatly cyanosed, with no consideration for antisepsis or asepsis, and with no instrument available but a pocket penknife—many lives have been saved in this way. Judgment, presence of mind, speed and accuracy are essential so that every nurse should recognize the indications for this treatment and should know instantly what to do. The patient is in immediate great suffering and danger and his life is at stake.

When there is time for preparation the following instruments should be brought to the bedside—a scalpel, 2 thumb forceps, a grooved director, 2 sharp tenacula, ½ doz. artery clamps, 2 retractors, needles, catgut and silk for ligatures and sutures, sterile gauze and several double tracheotomy tubes of several sizes and different curvatures. All the instruments must be sterile and the operation performed with strict aseptic precautions. Sterile cotton sponges, sterile wipes and a receptacle for the soiled sponges will also be needed.

Preparation of the Part.—The part, from the top of the larynx to the sternum, must be very carefully cleansed and disinfected as for a major operation.

The Anesthetic.—In severe cases, with dyspnea and cyanosis, it is said that the patient is so narcotized by the carbon dioxid poisoning as not to need an anesthetic. Sometimes a local anesthetic, for adults, is used—4 per cent. cocain injected subcutaneously. For children or nervous, hysterical patients a general anesthetic is given. Chloroform is used because much less irritating than ether and because the secretions are increased less than when ether is used.

The position of the patient is extremely important. A child should first be wrapped tightly in a sheet to prevent struggling. In all cases the patient should be in the dorsal recumbent position with a hard pillow or sandbag under the neck so that the head is low and the neck fully extended. This "steadies the trachea, makes it more superficial, lengthens the neck and the portion of the trachea in the neck and makes tense the structures in front" (Woolsey). The head in all cases must be kept *perfectly straight* as the incision must be made exactly in the median line. This is particularly important in a low tracheotomy because the common carotid arteries and other arteries are here so close to the sides of the trachea as to render them liable to injury if the position is not maintained, and interferes with the proper incision. The position is also extremely important with children because it is difficult to make the incision satisfactorily, due to the small size of the trachea (the full length of the cervical portion in a child from 3 to 5 years being only about 1½ inches), its depth and mobility and the high level at which the large blood vessels frequently cross it. (Woolsey.) The nurse is responsible for the preparation and the position of the patient.

During the procedure, the nurse should stand on the *left* of the patient ready to assist the surgeon as the need arises. The surgeon stands on the patient's *right*. When the operation is performed in diphtheria the doctor and nurse usually wear a mask to prevent infection from the spurting of secretions, etc.

The incision is first made through the skin and fascia, the muscles being separated (not cut) with retractors. There is sometimes severe hemorrhage due to severing of the congested blood vessels, so the nurse must be prepared with artery clamps and sponges, etc. When the incision (about three-fourths of an inch, at right angles) is made into the trachea there will be a rush of air with spasmodic coughing and considerable blood-streaked mucus with a sudden rising and falling of the trachea. This is allowed to subside before the tracheotomy tubes are inserted, the trachea being held open with the dilators. The tube used should not be too curved as it is said that the pressure from its sharp end may cause an ulceration into the innominate vein or artery or the common carotid and occasion a fatal hemorrhage. A number of cases have been reported where this has occurred. Silver tubes are used in preference to hard rubber as they are less irritating. Double tubes are used so that if one should become clogged with mucus it may be removed, cleansed and reinserted. The outer tube is held in place with tape, which is fastened around the neck. This outer tube is never removed by the nurse. A layer of soft sterile gauze is usually inserted between the plate of this metal tube and the skin to prevent irritation.

The patient must now breathe through this tube and as he depends entirely upon it the greatest vigilance must be observed in his care. The *inspired air*, which normally in its passage through the nose is moistened, filtered and warmed to body temperature, now passes directly into the trachea and lungs. One of the chief duties of the nurse in the care of the patient will be to artificially warm, moisten and filter the inspired air. Again, the expired air will be laden with increased mucus and particles of diphtheritic membrane or cancerous growths, etc. The patient cannot expectorate this or control it in any way and it all passes through the tube which may thus soon become clogged. As long as there is any danger from clogging of the tube, the patient must be watched constantly, never being left alone. The patient is also apt to be extremely nervous until accustomed to breathing through the tube. He may become very excited with the least difficulty in breathing or clogging of the tube and may in his excitement dislodge the tube and strangle to death.

The dangers following this operation may be:—(1) The spread of diphtheria to the wound, the trachea and bronchi with bronchopneumonia, which is usually fatal. (2) Infection of the wound —extreme care must be taken to prevent this. (3) Inhalation of infected matter (pus, etc.), resulting in septic pneumonia, usually fatal. (4) Pneumonia. (5) Shock. (6) Hemorrhage. (7) Displacement of the tube with danger of asphyxiation. If displaced, hold the opening apart with forceps or any instrument at hand until the doctor comes. Try to replace the tube but do not use force as this will cause injury to the tissues, which will make it very hard to reinsert the tube later. (8) Abscesses. (9) Emphysema of the thorax and tissues of the neck has followed a tracheotomy.

The After-care.—To supply the function of the upper respiratory tract—to moisten, filter and warm the air to body temperature. The temperature of the room should be about 80° F. Steam inhalations, with a croup tent, give great relief by warming and moistening the air. The tent must be well ventilated but there must be no drafts, great care being taken to prevent chilling with the danger of contracting pneumonia. While it is desirable to have the air warm and moist it must not be saturated and so hot as to give both patient and nurse a steam bath, thus increasing the risk of chilling and pneumonia.

Square pieces of gauze dampened with warm sterile water, boric acid or carbolic solution (1 to 60) should be kept over the mouth of the tube to moisten and filter the air. This should be changed as soon as dry or soiled with secretions, etc. Sterile gauze is also used to swab mucus, etc., away from around the tube. There should be no loose threads to the gauze as they might accidentally get into the tube and trachea and strangle the patient.

To keep the tube from becoming clogged, thus closing the passage and causing asphyxiation, constant watchfulness will be necessary, especially if there is much secretion from the lungs, etc. The patient must never be left alone if there is danger of the tube becoming clogged and the inner tube must be cleansed as often as necessary. This may be every few minutes or every hour, etc., depending upon the condition.

The inner tube may be removed, cleansed and boiled every fifteen minutes, if necessary, and reinserted. When there is considerable secretion, it may be necessary to have a second sterile tube to reinsert. Frequently it is unnecessary to remove the inner tube for cleansing. In this case, it should be cleansed with a feather (previously sterilized) and moistened in a salt solution or bicarbonate of soda solution which is alkaline and so readily dissolves and removes the mucus. The nurse must not remove the outer tube nor clean the inner tube with cotton on an applicator as there is great danger of its slipping or being retained in the narrow tube and strangling the patient. When inserting the feather be sure there is no excess solution on it to be squeezed out in the tube, trickle into the trachea and lungs, causing him to choke, cough and strangle. Again, do not insert it so far as to touch and tickle the patient's throat. This will cause such a spasm of coughing as to possibly strangle him. (If the air is dry this also tickles and irritates, causing a constant cough.) The doctor sometimes tickles the throat with the feather purposely in order to make the patient cough and force up mucus or diphtheritic membrane, etc.

Care must be taken not to displace the outer tube. Always note the position of the tube, the patient's breathing, color, pulse rate and temperature and whether bleeding or inflammation, etc., occurs around the tube.

The head of the patient should be kept slightly lowered to prevent the inhalation of blood or mucus.

The patient may be given liquid food through a tube by mouth or nasal feeding may be necessary. Later, when fed by mouth, the tube may be dispensed with and, in some cases, the patient can swallow soft solids with ease after becoming accustomed to the tube. The tube in the trachea does not interfere with swallowing for "the absence of cartilaginous rings between the trachea and esophagus avoids the pressure of the trachea upon the esophagus which might impede deglutition" (Woolsey).

The voice usually is just a whisper with a whistling sound but in some cases without complete obstruction, the voice may be fairly good when a finger is held over the mouth of the tube.

When the tube is finally removed the patient must be watched closely until the breathing is normal—some take a long time to resume normal breathing.

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